Graphic Analyses of Managerial Problems—*and articles on public policy and broad business topics, together with the regular departments devoted to operating practice and commercial problems.*

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Electrical World

New York, October 7, 1916 McGraw Publishing Co., Inc. Vol. 68, No. 15 10c a copy

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Electrical World

The consolidation of Electrical World and Engineer and American Electrician.
Published by McGraw Publishing Company, Inc.

Vol. 68 NEW YORK, SATURDAY, OCTOBER 7, 1916 No. 15

Centralization of Electrical Supply

TO engineers and executives in this country where centralization of electrical supply is becoming more and more general, the discussion now going on in England for a national treatment of the electricity supply problem is not without interest. There, in view of the situation created by the war and the Empire's fast diminishing coal reserves, engineers have again taken up the subject of economical generation and distribution of electrical energy. As a means to this end, the British Institution of Electrical Engineers has recommended a governmental tribunal to control the electricity supply industry and to prevent indiscriminate additions and extensions of power systems undesirable from the point of view of size, locality and system. More recently one of England's most eminent engineers, looking on the subject as a national problem and employing Ferranti's presidential address of 1910 as a text, has shown how 60,000,000 tons of coal might be saved annually in Great Britain just through centralization. He suggests what to an American is obvious—shut down the numerous heterogeneous stations, standardize the distribution systems and feed the circuits with electricity generated at a few huge plants, interconnected and strategically located as to fuel, water and load.

Large generating systems such as abound in this country are unknown in England, chiefly because there each municipality possesses its own system. The great city of London has some seventy-nine power stations, forty-nine systems of generating, ten frequencies, thirty-two generated voltages, twenty-four distributing voltages and seventy methods of charging, and so far all efforts to bring order out of this chaos have come to naught. But when as a last resort government control is suggested, and many feel that nothing short of that will remedy matters, immediately the financiers sense danger. They cite the effect of the Hydroelectric Power Commission of Ontario on private enterprise in that province of Canada, say that government control might lead to confiscation, will seriously depreciate the value of the investments, and will have none of it. True, London's problem is not simply solved by unification, there are financial problems to dispose of as well. But London is under-developed compared with American cities, and if it is to be a part of a national system financiers cannot stem the tide. What is economical must eventually prevail, and if no one else acts the British government probably will, and with it will undoubtedly come all the abuses of legislative and executive authority.

Fortunately, the majority of stations in this country are privately owned, and holding or operating companies can absorb the smaller utilities and make them a part of a great system fed from a transmission network. Holding companies are able to exist in the utility field because they can take advantage of a situation like that now confronting England, and by combining and unifying systems effect sufficient economies to justify their existence. The municipally-owned systems have not that advantage, and therefore when viewed nationally are uneconomical. In output, however, they form so small a part of the whole in this country as not to offer a serious problem. Besides, the United States possesses more than one-half of the estimated coal in the world, and Great Britain only one-fortieth, so the fuel questions are not the same. Nevertheless, with all our shortcomings, and we are conscious of them, we lead the world in the economical generation, distribution and use of electricity. While other brands of efficiency are being paraded, we suggest in all humbleness that American efficiency is worth consideration.

Interpreting Engineering to the Public

IN any special group, such as a village, there are certain men whose influence is thought to be public and generalized, rather than restricted to their own circle of friends and immediate acquaintances. Prominent among the public men, and in approximately the order named, are the minister, the lawyer, the physician, the politician, the banker and the teacher. The sayings of all of these are widely circulated, and each one's expressions of his point of view have marked effects upon the people at large. It is a fact, though a sorry one, that the vast majority has not yet learned to form its own conclusions from any given set of conditions, but relies upon hearing the statement of a plausible opinion which may be appropriated and restated as though it were a conclusion personally reached. Thus the men whose thoughts are forcibly and widely expressed secure large followings composed of echoing and often unthinking satellites.

The minister, the teacher and the physician hold beliefs, as to public questions, which are in general highly academic, divorced as they are from the give and take of affairs gained in practical business. The banker, on the other hand, is usually so close to the financial side of the problem that his point of view is not inclusive. The politician in his turn is suspected by the people. The lawyer alone, of the six professions, is likely to combine a scholastic training with a certain conception of business conditions. He is handicapped, however, in that his experiences with banking, trade and manu-

facturers never come to him first-hand. He is forever sitting back in his office chair while his clients relate to him their own affairs. Such a position is bound to give a degree of mental perspective, but it is unfortunately true that the constricting effect of the normal legal atmosphere often tends to produce the type of mind which insists upon classifying everything according to precedent.

There is just one group in the community to whom it may logically look for constructive leadership—the engineers. And the engineer's position to-day is growing more important. For example, a doctor in a small town visits the big city. He gets certain comforts from ten-minute trolley service. He comes back with the idea that the local company ought to give more frequent service, and talks about it. People agree with him, and an agitation is started simply because the doctor, in all sincerity, doesn't recognize that the number of customers carried per trip and the number that can be carried are very different in his town and the big city. This example sounds obvious, but the story is true. An engineer at least could analyze the facts and put them straight. How many similar difficulties between the utility and the customer fall back upon the simple truth that no one has presented the facts logically. The engineer has a very real opportunity as a public servant. Public policies are in the making. There is much discussion with too few facts. The engineer can at least see to it that the business and engineering factors involved are clearly understood. He should do so.

We Shall Invest in Other Lands

THERE are historic instances in the central station industry of courageous operators who went to Europe in order to exchange their securities for cash. And these instances are not confined to the early days of hazard and experimentation, as some of them but shortly antedate the war which has altered all things. That the securities thus placed abroad have been largely repurchased on this side of the ocean is only one of the remarkable developments of this era of transformation. Another, toward which we are steadily approaching, is the assured investment of American capital in utilities located in foreign lands. From looking to Europe for capital we are turning, with pioneering capital to our credit in the banks, to other countries having latent powers and opportunities awaiting development. The fact is that at present the question really is, can these countries offer conditions which safeguard the investment and the return? Can these countries, say in South America, promise adequate protection and the terms which alone will make the securities of public utilities in remote lands attractive to the uninformed but willing investor in this country? It is well understood that in the past the details of franchise contracts in foreign lands have not been those which the investor in the United States regarded as necessary to his protection. But if these can be made satisfactory, if a friendly public attitude can be promised and if the problem of rate of exchange can be surmounted, capital will be forthcoming. It is confidently believed that these impediments will be removed and that capital will flow from our investment centers toward those nations which meet our reasonable conditions. With capital will go trained men and knowledge of our enterprising operating and business methods, likewise our apparatus and appliances. The time of accomplishment is not far distant.

Cost Records Guide Appraisal Work

BEFORE the era of public service commissions came, arguments did not always convince a public utility company of the need of complete records on costs of different elements of property, but actual experience with an appraisal by a rate regulating commission usually leads promptly to a prudent decision that full data on such facts are real assets. True costs of material and labor, owing to inevitable difficulties in installation and the perfection of operation, are likely to be greater than the figures made by the appraisal engineer who views the completed work and is ignorant of the obstacles confronted by the pioneers. In many instances actual costs are far greater than the finished structure indicates. In the valuation of the tube distribution system which is described elsewhere in this issue the inspection of all available records and the deductions to which they pointed gave a basis which the appraiser regarded as satisfactory. It will occur to some readers, however, that the method of computation of discounts, if applied indiscriminately, might be open to question. At the present time, owing to scarcity of materials, a buyer might not only not get the discount which would be allowed in normal seasons, but he might gladly pay a premium for early delivery. However, the important point is that uncertainty is less desirable as a basis in appraisals than a substantial groundwork of indisputable records. When data going back to the small capital investment at the beginning of the industry are so vital as they are shown to be in this case, it is plainly the duty of every company to preserve explicit details of its greater costs with the enormous financial outlays of present times.

Effects of Temperature on Storage Cells

IT is a well-recognized rule that for primary voltaic cells, the output tends to increase with temperature, up to a certain limit. A primary cell which has a satisfactory output at ordinary room temperatures, shrinks in its output as the temperature falls toward 0 deg. C., and increases its activity as the temperature rises, say, toward 40 deg. C. One reason for this behavior is the change in internal resistance, which is ordinarily much lower at 40 deg. C., than at 10 deg. C. Another reason is the greater speed of ions and of chemical reactions as the temperature is increased. The paper by L. C. Turnock on the performance of the Edison storage cell, as affected by temperature, which was read at last week's meeting of the American Electrochemical Society, is referred to in this week's *Digest*. Storage

cells are essentially voltaic cells, in which the plates are restored electrochemically, and they manifest the general characteristics of primary cells already mentioned in regard to the effects of temperature. It is well known that the output of storage cells dwindles toward low temperatures, and increases in the summer season.

The paper investigates the behavior of some test cells, at different temperatures of charge and discharge. It is shown that the current efficiency increased as the temperature was raised up to 50 deg. C. Above this temperature there was a rapid falling off. The best conditions for output were indicated as a charge at a moderate room temperature, followed by a discharge at a higher temperature not exceeding 50 deg. C. According to this, the motto of the best operating cycle would be—charge cool and discharge warm. Several reasons are suggested for the falling off in output at temperatures above 50 deg. C., but fortunately, for many purposes, storage batteries do not need to be operated at such high temperatures. It is important to know, however, that an alkaline storage cell is subject to deterioration, if allowed to stand at a temperature above 50 deg. C.

Analyzing Statistics Graphically

ALTHOUGH our readers are familiar with the application of graphical methods to engineering, the article by E. D. Dreyfus in this issue will be of interest since it deals with special applications of the graphical methods which are a little outside ordinary practice. The author's discussion shows how methods which appeal at once to the eye and the intelligence can be utilized in co-ordinating apparently intricate data so that their true relations may be seen, even when these do not apply strictly to engineering matters but to the complex data of business. Not only can facts which to the casual observer seem unrelated be made amenable to graphical methods, but these often serve to bring out correlations which are quite unsuspected. Things apparently independent when plotted on co-ordinate paper often show a systematic trend which points the way to a generalization of real value.

In working through graphics one has, however, to be exceedingly cautious in certain particulars, for instance, when a set of figures, dynamical or financial, are available they are, so long as they are tabulated, instinctively taken merely at their face value. When plotted, however, there is a temptation to extrapolation which is well nigh irresistible to the untrained mind. Sometimes the process can be safely employed, but it requires a rather comprehensive knowledge of the facts that lie back of the data to tell when to go ahead and when to stop.

For example, take the curve which represents the increase of train resistance with increasing speed. The curve is a rather gentle one and as the experimental data are generally not very precise the points secured from a moderate range of speed can be represented almost equally well by a straight line or by several types of curve. If continued in either direction both line and curves are likely to lead to exceedingly wild results, as experience has amply shown, merely from departure of the real data from the extrapolated value. Again, a curve may apparently go on from the plotted data in a beautifully systematic manner with every indication that it will presently become asymptotic, only to pass through a maximum and turn downward to the utter confusion of hypotheses drawn from its early course. Plenty of such instances can be found in engineering data.

Again, even interpolation is not always safe, since a curve not infrequently undergoes a radical change of curvature at some particular point or points, resuming afterward an orderly progression. In this case groups of points taken too far apart and apparently quite consistent may lead to astounding blunders. Instances of this sort may be found in the curves connecting the velocity and air resistance of projectiles, speed and driving power in ships, and in numerous other instances, some of them of a very unexpected character. Finally the student of graphics must watch cautiously lest he be deceived into drawing a smooth curve which may conceal some of the very facts that he sought to discover.

Averages, in other words, have a wonderful facility at covering up significant variations from them. These warnings do not in any sense detract from the value of Mr. Dreyfus's paper, but are merely presented for their bearing on graphical practice. Curves should be used, even much more than at present, to put in usable form the practical data of engineering, yet they need careful scrutiny in cases where the data are incomplete or where it is difficult to see from theory what the general form of the curve is likely to be. Oftentimes significant facts turn up in plotting data to polar or logarithmic co-ordinates which are not at all obvious by the ordinary methods.

The Coming Issues

NEXT week in the station operating number of the ELECTRICAL WORLD for October, the second issue of the month, feature articles will describe the load-dispatching practice of the New England Power Company, and the use of iron and steel wire for transmission-line construction. Beside other articles on station operating practice there will be the regular weekly departments for the technical and the commercial man. The Oct. 21 number, the engineering issue of the month, will include a leading article on the engineering design and construction of an electrically operated cotton mill in Alabama, together with an account of efficiency tests conducted on the equipment. In the same issue will appear a review of the results of an experimental investigation of temperature distribution around a synchronous converter armature, together with the usual weekly departments. The fourth number of ELECTRICAL MERCHANDISING, the new monthly magazine of the electrical trade, will be issued on Oct. 15.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

CIVIC ORGANIZATION OF ENGINEERS DISCUSSED

Proposal Made That Naval Consulting Board's Industrial Preparedness Committee Be Made the Nucleus for a General Technical Body

The question of whether the engineers and chemists of the country should form an organization for the consideration of, and action on, public questions of an engineering nature was put before a gathering of engineers called together at a luncheon at New York on Sept. 28 by W. L. Saunders, past-president of the American Institute of Mining Engineers and a member of the Naval Consulting Board. The governing thought, Mr. Saunders explained, was whether since an organization of engineers for civic work had been created by the Naval Consulting Board, through its committee on industrial preparedness, it is not wise to hold the organization together and to make it permanent. Such problems as the conservation of our natural resources, mining laws, and railroad regulation, river and harbor appropriations might be considered. Mr. Saunders proposed that the new organization be independent of the national engineering and chemical societies, but that the qualification for membership in the new body would be membership in the existing national professional organizations.

A general discussion followed Mr. Saunders' statement. Most of the speakers believed that the national engineering and chemical societies would not be inclined to take suitable action on civic questions, and therefore favored the perpetuation of the Naval Consulting Board's organization. It was pointed out, however, that the existing bodies are well organized and have the necessary machinery for effective action. On one point there was unanimity—that there should be some agency by which the engineers and chemists could exercise an influence in public life. There was a difference of opinion only on what the agency should be.

As a result of the discussion it was voted that the chairman should appoint a committee of five to consider the question from the various angles brought out in the discussion and to report conclusions at a later meeting. Mr. Saunders is to be an ex-officio member of the committee.

The committee, as appointed by the chairman, is as follows: J. J. Carty, past-president of the American Institute of Electrical Engineers; Charles Warren Hunt, secretary American Society of Civil Engineers; Calvin W. Rice, secretary American Society of Mechanical Engineers; Thomas Robins, member of the Institute of Mining Engineers; Benjamin B. Thayer, director the Engineering Foundation.

Embargo on Electric Vehicles and Accessories to Be Reviewed

Advices from the London office of the ELECTRICAL WORLD this week state that correspondence has taken place between the Board of Trade and the electric vehicle committee of the Incorporated Municipal Electrical Association with regard to import restrictions. The secretary of the committee wrote to the Board of Trade on July 7, pointing out the increasing adoption of the electric storage-battery vehicle for commercial purposes, and asking that the import restrictions upon commercial vehicles be reviewed in respect to storage-battery vehicles owing to the impossibility of obtaining such vehicles of British make. The effect upon the electric supply industry was pointed out, as was the ease of the control of such vehicles which enables men of military age to be released for service with the forces as women or elderly men can be made proficient drivers after but a few hours' tuition. It was pointed out also that there is at the present time only one British firm making the heavy type of commercial electric vehicle now in such demand, and it is understood that the company is quite unable to cope with the orders coming to it, as it has but recently taken up this line of manufacture and is heavily involved in the production of munitions of war. It was therefore asked that there should be free importation at the present time of American built commercial electric vehicle chassis. The Board of Trade replied on July 11 to the effect that if the committee would send a statutory declaration to the effect that the chassis it was desired to import are to be used solely for commercial purposes, the matter of their importation should have consideration.

Standardization of Line Construction in California

The Railroad Commission of California has issued fifty-eight orders to electric and telephone corporations looking to the safety of human life by the standardization of electric and telephone transmission system construction, and involving the spending of more than $750,000 to this end. The orders took the form of authority for extensions of time within which these public utilities may comply with Chapter 499 of the laws of 1911, as amended by Chapter 600 of the laws of 1915 referring to the placing, erection, use and maintenance of electric poles, wires, cables and appliances.

The Legislature passed this act for the purpose of removing the danger to employees engaged in the construction, reconstruction, maintenance and use of such property, and of the general public. The statute provided that it become effective six months from the date of its passage in so far as it relates to new work, and that five years should be allowed for the rebuilding of existing work to meet the provisions of the law. The Legislature in 1915 amended its previous act, and vested in the Railroad Commission the authority at its discretion to grant additional time to corporations, and instructed it to pass on all work done.

The commission's order names specifically the period within which each utility must do a third and also two-thirds and the entire work, which last must be completed before June 30, 1919. All the companies are to report to the commission from time to time as ordered upon the progress of the changes. The orders direct the companies to proceed with the work as rapidly as possible, and vary in length of extensions granted according to the conditions under which the utility operates.

SALT LAKE CITY'S WHITE WAY

New System Designed by W. D'A. Ryan Covers Entire Retail Business District

Salt Lake City celebrated the inauguration of its new "White Way" lighting district on the evening of Sept. 29 with ceremonies the like of which have not been seen for many days. Those in charge of the exercises were completely surprised at the interest displayed by the populace in the ceremonies. Main Street, which is generally known as one of the widest business thoroughfares in the country, was completely jammed for a distance of nearly two blocks. The Utah Power & Light Company had erected a large platform in front of its last speaker. He praised the progressive citizens of Salt Lake City which made this enterprise possible, thanked those responsible for its being, and declared that this type of lighting hereafter would be known as the "Salt Lake System," and that Salt Lake City would derive much desirable publicity therefrom.

There are seven standards to the block on each side of the street approximately 100 ft. apart. Each standard carries three 6.6-amp. inverted-type luminous-arc lamps. The standard fits over the regular trolley pole and completely conceals it. It has an ornamental cast-iron base and a pressed steel column in two sections with the three-arm cast-iron fixture carrying the lamp mounted on top. The lamps are equipped with diffusing

MAIN STREET, SALT LAKE CITY, AT NIGHT AND NEW LIGHTING STANDARD EMPLOYED IN ITS ILLUMINATION

general offices on Main Street on which had congregated the president and board of governors of the Commercial Club, representatives of the Upper Main Street Improvement Association, prominent property owners, and citizens and representatives of the Utah Power & Light Company. This new lighting system, which is generally referred to as the Salt Lake system, extends from South Temple Street to Fifth South Street on Main Street, a distance of five blocks or approximately 0.75 mile. It covers the entire retail business district on this main street.

President F. C. Richmond of the Salt Lake City Commercial Club, acted as master of the ceremonies and introduced the speakers. The Hon. John C. Cutler, president of the Upper Main Street Improvement Association, briefly outlined its history.

W. D'Arcy Ryan, the designer of the system, made a special trip from San Francisco to attend the ceremonies, and was greeted by rounds of applause when introduced. Mr. Ryan stated that on account of its broad streets, Salt Lake City presented an unusually interesting problem in special street lighting design. He called attention to the fact that he had promised the property owners that they should have a substantial, dignified standard, with an evenly distributed illumination well out of the eyes of the pedestrians, which would give a practically uniform distribution of light on the street, sidewalk, and façade of the buildings. He called upon the throng present when the system was turned on to witness how nearly his promise had been fulfilled.

The Hon. W. Mont. Ferry, Mayor of the city, was the

glassware. Each lamp is rated at 1500 cp., and the absorption is approximately 30 per cent. They are connected on two circuits, one circuit supplying 190 lamps, which operates until midnight, the remaining twenty lamps burning all night.

The total cost of installation of the system was $28,220. The cost to the property owners was $25,535, and the city bore the balance of the expense. The installation charge against the property owners amounts to $4.12 per front foot. The total cost of operation for the three-year period of the contract is $28,138, of which amount the city pays approximately $4,000. The cost of operation to the property owners is approximately $1.30 per front foot per year. The Utah Power & Light Company spent approximately $12,000 for the necessary rectifiers and other station equipment.

Germans Building Largest Generator in the World

We are advised by Dr. Karl Georg Frank, the American representative of the Siemens-Schuckert-Werke of Berlin, Germany, that that company is now building a 60,000-kva. generator wound for 6600 volts and operating at 1000 r.p.m. The generator is intended for the Rheinische Westphaelische Elecktrizitaets Werke, and will be delivered by April 1, 1917, which throws interesting light on the conditions of the German electrical industry in spite of the war. The 6600-volt energy will be stepped up to 110,000 volts for transmission in a 60,000-kva. transformer.

UNIFORM INSPECTION DISCUSSED

That and Other Topics Occupy Attention of New England Electrical Contractors at Hartford Convention

Uniform inspection, the working of the Massachusetts electricians' license law, trade relations and accounting were the principal topics of discussion at the Hartford, Conn., convention of New England electrical contractors Sept. 27 and 28. A note referring to the opening of the convention appeared in the ELECTRICAL WORLD of Sept. 30, page 652. A feature of the opening session was an address by Robley D. Stearns, New Orleans, La., president of the National Electrical Contractors' Association, who paid a high tribute to the work of his predecessors. The present membership of the National association exceeds 1200. Colonel Stearns declared that with an annual purchasing power of $25,000,000, the members of the association are in a position to obtain recognition of their interests throughout the electrical field. The speaker held that knowledge of manufacturing costs would help to create a better understanding between contractors, jobbers and manufacturers, a fair profit for each being desirable.

W. K. Tuohey, Springfield, Mass., past-president of the National association, reviewed the benefits of organization among contractors, which he said were not sufficiently appreciated as yet. Electrical contracting has a better outlook than any other branch of the building trade, provided the men in the business co-operate. An organization of jobbers in New England would be of much mutual benefit, the speaker declared, and there is a field for the establishment of a central credit bureau for the benefit of both contractors and jobbers.

J. E. Wilson, Boston, Mass., read a paper on the Massachusetts license law for electricians, from which he stated much good has resulted. The law compels a man to be over eighteen years of age before taking an examination, and the five years' experience clause has been eliminated, thus preventing undesirable wiremen from obtaining a license by a false statement. The Massachusetts association has caused the arrest and imposed a fine upon men who sought to avoid the law, and has compelled others to take examinations and secure a license. Over 200 have failed in the examinations and been refused licenses, all of whom would have been undesirable competitors and inefficient workmen. Complaints are now practically non-existent relative to violations. At the next session of the Massachusetts Legislature various amendments are to be introduced, including the establishment of four classes of licenses in place of the existing two classes. This will meet the needs of fixture houses, manufacturers, etc., fixture installers and moving picture operators, who are not in lines calling for skilled wiremen. Responses to a recent letter sent to 150 contractors in Massachusetts regarding the working of the law were generally highly favorable to the statute.

Uniform Inspection of Electrical Installations

Ralph Sweetland, engineer in charge New England Insurance Exchange, Boston, in a paper based upon twenty-two years' experience, pointed out the benefits of uniform inspection. It benefits the property owner through the disinterested certificate granted the installation; assists the reputable contractor in checking up his men, enabling him to present a bill for final and complete payment to the owner or his architect; helps the cheap contractor by driving him to do better work or leave the business, and is helpful to the underwriters, because it guarantees a reasonable degree of protection against fire risk.

A. J. Hixon, Boston, president of the Electrical Contractors' Association of Massachusetts, showed how the industry suffers from a lack of universal and uniform inspection in different localities. The author believed that too much money is being expended on inspection in particular localities, leaving others without such service. No uniform rule at present exists as to who shall bear the expense of inspection.

G. E. Bruen, Suburban Fire Insurance Exchange, New York City, outlined the work of his organization, and cited the excellent results of inspection by a specialized staff on a fee basis. Charges for inspection are made according to a well-defined and complete schedule payable in advance except by contractors of established credit. These charges begin with a price of $1 for the first inspection of ten lights or less, and there is a minimum charge of $1 for each reinspection. The inspection certificate establishes the confidence of the public in the safety of electrical service. The Appellate Division, New York Courts, has held that it is both lawful and reasonable for a New York City central station to refuse to furnish electricity without the certificate of the Board of Fire Underwriters. President Stearns of the National association favored inspection by insurance interests, and suggested further discussion of the subject through a committee. In the general discussion following, the great need of inspection in all municipalities not having it at present was voiced. Mr. Hixon suggested that so-called "outlaw" towns could be brought to terms by increasing the insurance rates.

Trade Relations

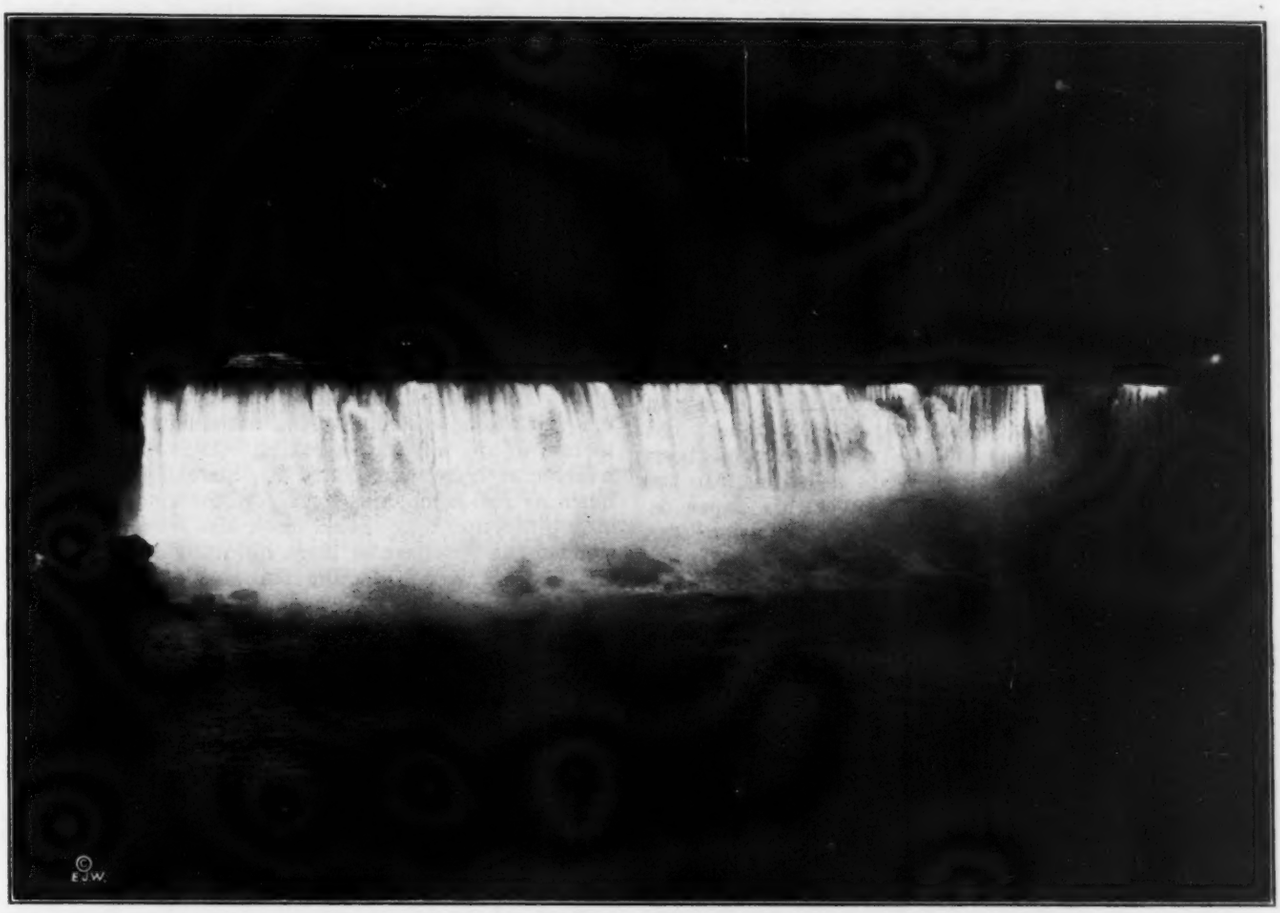
At the opening session Thursday Earl E. Whitehorne, contributing editor ELECTRICAL WORLD and ELECTRICAL MERCHANDISING, New York, addressed the convention on behalf of the Society for Electrical Development, emphasizing its value to the industry and outlining the benefits gained through national commercial service, supplemented by efficient local work. The speaker pointed out the importance of becoming actively associated with plans for turning America's Electrical Week this year into still greater rewards than were enjoyed in 1915 on account of Electrical Prosperity Week. Mr. Whitehorne cited the efforts of the society in eliminating wrong impressions about the safety of electrical service, objectionable and untruthful features having been removed from motion-picture plays through the activities of the organization.

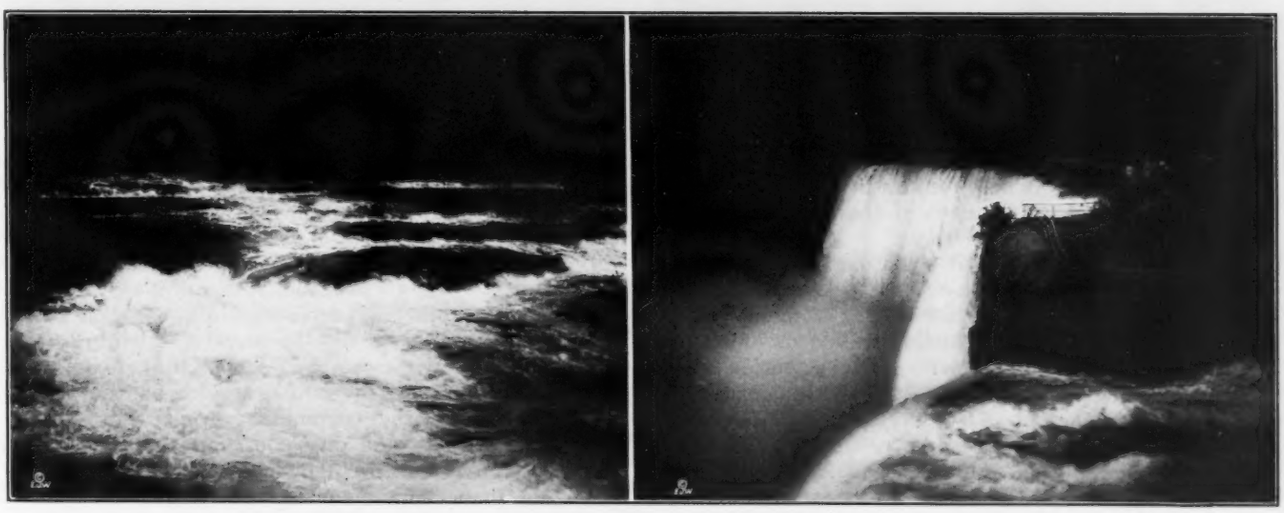
A vigorous discussion followed the presentation of a brief report by W. F. Abely of Boston on the work of the trade relations' committee in the past year. The report indicated that the members had learned something about the problems of the contractor and jobber, but intimated that it had been impossible to make constructive progress in the period covered. W. K. Tuohey, Springfield, Mass., led the attack on the report and voiced the difficulties confronting contractors in their relations with jobbers and manufacturers. He maintained that a jobber's organization would be helpful to the entire industry, on account of the possibility of thus securing responsible action in mutual discussions. George J. Murphy of the Pettingell-Andrews Company, Boston, said that the jobber members of the committee need more power behind their recommendations. He felt that the local contractor and dealer can develop profitable "pick-up" business in small towns having large industrial plants without the necessity of carrying a large "overhead" in the shape of stock suitable to the broader requirements of such plants. The speaker said that it is impossible to legislate against an economic law, and the development of chain drug stores open eighteen hours a day and 365 days a year has furnished an outlet for certain kinds of electrical

goods that must continue to be utilized. Mr. Abely said that if local contractors would "get busy" with their local wiring inspectors, many of their troubles relative to the sale of cheap wiring material would disappear. It was voted to discharge the committee and to appoint a new one.

Illumination of Niagara Falls

On Sept. 2 we published a short news item on the illumination of the American side of Niagara Falls by the Western-Davis system. The scheme of flood-lighting was inaugurated on the night of Aug. 26 and the photographs at that time available did not do justice to the work. Through the courtesy of Paul A. Schoellkopf of the Hydraulic Power Company, who is also a member of the committee which was instrumental in effecting the permanent illumination of Niagara Falls, we are enabled to publish a number of more recent photographs which give a much better comprehension of what the American Falls and the rapids just above them look like under electric light.





THE AMERICAN SIDE OF NIAGARA FALLS AND THE RAPIDS IMMEDIATELY ABOVE THEM AS NOW ILLUMINATED EVERY NIGHT

F. L. Barnes, Boston, described the co-operative efforts leading to the passage of the Massachusetts license law, all possible interests having been "lined up" in favor of the act before the legislative committee was approached. The co-operation of the labor unions was particularly helpful. At the final session an address was given on "Account Keeping for Contractors" by Percy Rothwell, Hartford.

COLORADO UTILITIES MEET IN ANNUAL CONVENTION

Papers Dealing with Commercial and Regulatory Topics Read and Discussed at Largest Meeting in Association's History

The fourteenth annual convention of the Colorado Electric Light, Power & Railway Association at Glenwood Springs, from Sept. 21 to 23, was the largest in the association's history. In his presidential address John J. Cooper of Denver outlined some of the work of the past year. The first paper, "Utility Investments," by W. C. Sterne, president of the Municipal Properties Investment Company, Denver, called attention to the fact that the day is past when the public gives little study to its investments. Among the important things which the present-day investor wants to know are: The efficiency of management at the time of investment, dangers of differences with municipalities and of labor and wage difficulties, variations in prices of materials, the extent of rate and service regulations, an accurate forecast of depreciation elements, the effect of management changes, effect of periods of business depression on earnings, character and plane of political activity, financial plan upon which the utility is to be or has been established, and marketability of its securities. In the absence of L. P. Hammond of Denver, his paper on "Sensible Rates for Lighting, Cooking and Power" was read by E. L. Siekman. The paper related the experience of the Colorado Power Company with its "two-rate demand" system of charging. The rate has proved entirely satisfactory for all classes of lighting, cooking and power encountered in the average domestic or commercial installation. It is not used, however, with industrial or mining power.

H. L. Titus, general manager of the Platte Valley district of the Colorado Power Company, opened Friday's session with a paper entitled "The Electric Range Game," in which he made the prediction that within ten years electric cooking would be one of the main features of central station business and lighting merely a subsidiary. The smaller communities, said he, have already been sold electric service to the extent of 98 per cent, and the electric range is the only field left to insure an increase in the consumption of electric energy in the future.

In discussing this paper F. P. Wood of Trinidad stated that until a satisfactory water heater is found very little can be done with the electric range. J. A. Clay advised watching ranges after sales. If the minor details are watched, for the first two weeks, Mr. Clay believes that 90 per cent of the objections to the electric range will be removed.

F. J. Rankin, engineer of the Colorado commission, presented a paper on "Service Rules." While practically all public utility laws authorize the commissions to establish adequate and reasonable standards of service, said Mr. Rankin, comparatively little attention seems to have been given to the quality and uniformity of service being rendered. In general, said he, the Colorado commission believes that those service rules, under which the maximum amount of service can be delivered to the consumer for $1, are the most satisfactory and practical. Mr. Rankin announced that while it is possible that in the near future the commission will take some action on the National Electrical Safety Code, it is not likely that it will be adopted in the form of an order for some time to come.

The paper on "Customer Ownership," by William H. Hodge, manager of the publicity department of H. M. Byllesby & Company, Chicago, was presented by W. F. Raber, Pueblo, in the absence of the author. The paper covered the matter of inducing consumers of a public utility to become financial partners in the enterprise and dealt with the experimental plan initiated to sell utility stock to utility customers in cities and towns served by the Northern States Power Company.

M. H. Aylsworth, chairman of the Colorado commission, speaking on "Utility Regulation," reviewed several recent decisions of the Supreme Court of Colorado which directly affect public utilities. One of these, wherein the court held that no state court can interfere with the public utility commission in its decisions under the act, he declared is of vital importance.

S. E. Doane, chief engineer of the National Lamp Works of the General Electric Company, Cleveland, followed with a talk on "How You Can Get More Lamps Into Use," in which he stated that the day is coming when light will be sold on its quality; the dealer will not sell lamps, but will sell light. H. W. Alexander of the Society for Electrical Development, speaking of "America's Electrical Week," explained the national advertising campaign planned by the society. "Transformers and Protective Devices," by C. B. J. Wheatlake of the Genearl Electric Company, was the topic of the next paper. Mr. Wheatlake said that the protection of transformers may be made as complete and satisfactory as the protection of any apparatus, but unfortunately this fact is not yet entirely appreciated by operating men. Inasmuch as few companies have now the amount of lightning protection they should have, Mr. Wheatlake recommended the purchase of more lightning arresters without fear of over-protecting transformers or of drawing too much on the company's financial resources. H. C. Phelps of the United States Bureau of Standards concluded the day's program with a paper on "Some Features of the National Electrical Safety Code."

On Saturday F. W. Herbert, statistician of the Colorado commission, opened the proceedings with a paper on "Depreciation Accounts," which excited considerable discussion. The depreciation account of the utility should show in detail the "build-up" of the depreciation reserve so it may be prepared to give a correct analysis of the charges and credits to this reserve. The distinction between repairs and replacements, said Mr. Herbert, or items that should be charged to maintenance or reserves, must be determined for each individual case. He favored charging all repairs and minor replacements to the operating expense accounts and providing in the reserve for replacement of major units only.

WHAT TO TELL THE PUBLIC

The paper "Tell the Public What You're Doing," by S. J. Ballinger, advertising manager of the Trinidad (Col.) Electric Transmission, Railway & Gas Company, could be epitomized in the sentence, "Tell them everything." In advertising, he advised that the public be told what it costs to produce, transmit and distribute electrical energy. The people should know some of the disagreeable and expensive features of the work; they should know what the company spends in its home town, the influence of efficient public service on the growth and progress of the community, what the company spends for charity and city boosting, and the amount of taxes paid for different purposes.

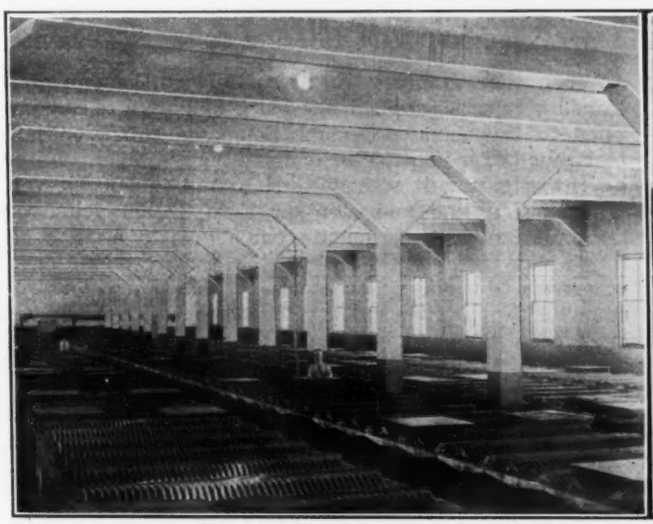
The last paper of the convention, "Maximum Demand Meters and Their Application," by S. G. Hibben of the Westinghouse Electric & Manufacturing Company, was read by B. S. Manuel. As stated in this paper, recent developments in demand meters have been along two distinct lines: those instruments in which deflection is retarded or purposely made sluggish—known as "lagged demand meters"—and those instruments whose demand-recording mechanism is periodically reset to zero by a clock or equivalent time-keeping device, known as "interval demand meters."

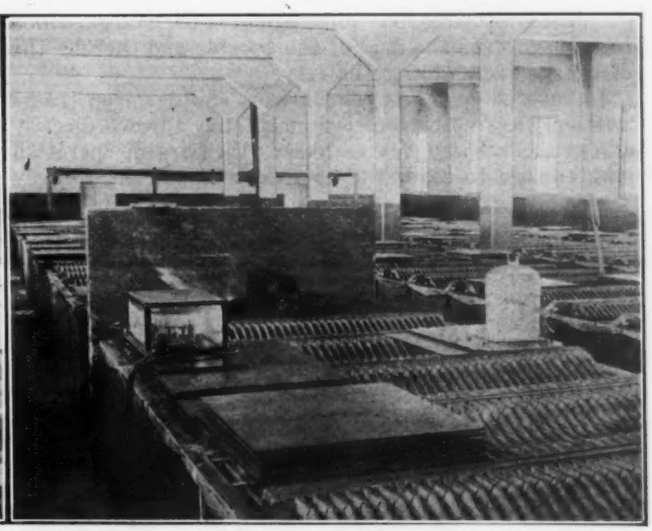
Recent Installations Made by Winnipeg Company

Features of a 5000-amp.-hr. Storage Battery Installation by Winnipeg Electric Railway Company for Railway Service and Arrangements to Serve a Large Cement Works

BY H. A. P. LANGSTAFF

A SPECIAL battery building has recently been constructed by the Winnipeg Electric Railway Company near its Mill Street substation to house a 5000-amp.-hr. storage battery which is to be used for standby railway service and for improving the station load factor. This battery building is 41 ft. wide by 196 ft. long and 16 ft. high, and provides space for a fan room 41 ft. long by 12 ft. wide by 10.5 ft. high at one end and for a switchboard room at the other end. The foundations of this structure are of concrete with piers extending 6 ft. below grade. The double concrete roof, with 3-in. air space and four monitor roof ventilators, has a tarred, felt and gravel covering supported by reinforced concrete pillars. The floor is made of vitrified brick pavement with asphaltum filler laid on 8-in. concrete base having a fall of 17 in. from one end to the other. The building is ventilated by an indirect steam heating system, air being forced through steam heated coils into concrete ducts running longitudinally the entire length of the building, allowing air to circulate up into the battery room and out through the monitor ventilators. The lighting system consists of conduit piping laid in the concrete ceiling supplied with vaporproof fixtures at outlets.





FIGS. 1 AND 2—INTERIOR OF BATTERY ROOM SHOWING CELL ARRANGEMENT AND INSTALLATION OF RECORDING HYDROMETER

STORAGE BATTERY AND RECORDING HYDROMETER

The battery is of the R. Tudor accumulator type with a rating of 5000 amp.-hr. There are a total of 286 cells, each composed of eighty-five plates 18⅝ in. by 18⅝ in. in lead-lined, specially constructed wooden tanks, each supported on ten oil insulated porcelain supports. Interior views of the battery room are shown in Figs. 1 and 2. All lead connections were burned in, and the terminal cell connections are made of lead-coated copper bus.

A compensating and recording hydrometer installed in lead-glass case gives a constant record of specific gravity, and also indicates by means of bell alarm to the switchboard operator when certain charging point has been reached. This device is shown in Fig. 2.

The battery is connected to the Mill Street substation by ten 2,000,000 circ. mil cables run in a twelve-duct underground run from the battery building. Several other cables, such as the three connections to three individual cells for operation of a carbon pile regulator, and alarm bell wires and local telephone cables, occupy the other two ducts.

In conjunction with the battery there is installed in the Mill Street substation a 3300-amp., 175-volt, interpole-type booster set driven by a 650-hp., 2200-volt induction motor running at 300 r.p.m. This interpole type of booster has given perfect satisfaction. Another 6-hp., 220-volt induction motor directly connected to a 250 to 650-volt, 15.5-amp., continuous-current generator helps to control the field of the booster when operating on automatic control.

CONTROL PANELS FOR BOOSTER SET

The control panels for booster set and the carbon pile regulator are mounted between one of the railway generator panels and one of the alternating-current synchronous motor-control panels, as shown in Fig. 7. The main control panels for storage battery are mounted at the end of the railway feeder panels, as shown in Fig. 6.

The battery is protected by a 6000-amp., 650-volt circuit breaker mounted on reinforced marble board. A single-pole, double-throw switch allows the battery to be operated in conjunction with the booster, or in case of emergency to be thrown directly across the railway bus.

OPERATION AND CONTROL OF BATTERY

The discharge from the battery may be controlled either manually or automatically. The former control is obtained by means of a hand-operated rheostat connected in the field of the booster and mounted directly over battery control panel. The automatic regulation is controlled by the alternating-current supply end of substation. This is obtained by connecting a current

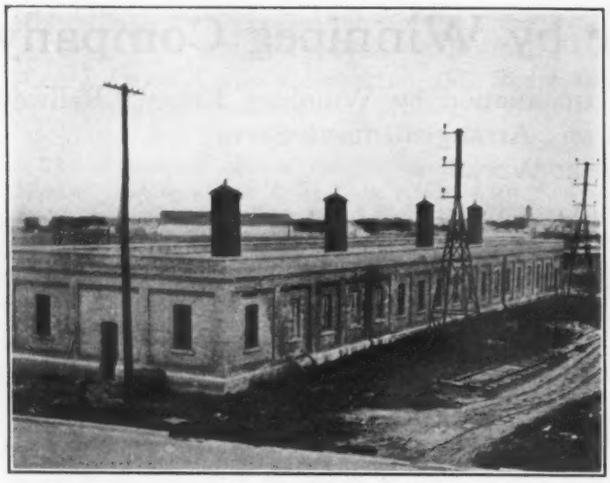


FIG. 3—STRUCTURE BUILT TO HOUSE 5000 AMP.-HR. STORAGE BATTERY

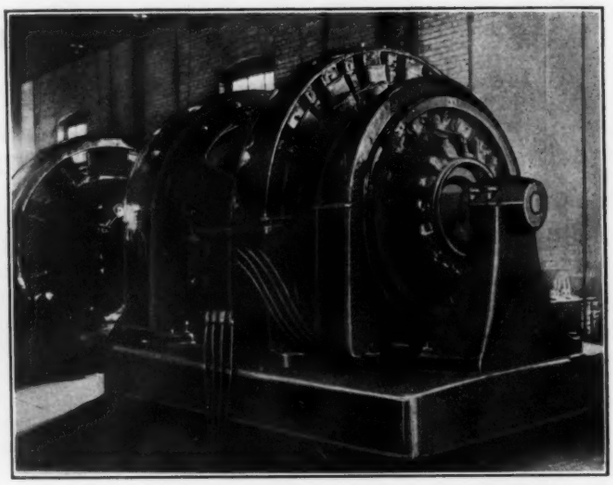


FIG. 4—INTERPOLE BOOSTER SET USED WITH BATTERY AND RATED AT 3300 AMP., 175 VOLTS

transformer in one leg of the 2200-volt side of each of the five banks of transformers, and also in one leg of the 2200-volt bus from steam turbine plant. The secondaries of each of these six transformers are connected in multiple, through a totalizing current transformer, the secondary of which is connected to a solenoid mounted on the back of the carbon pile regulator panel. The moving element of this solenoid is mechanically connected to the carbon pile regulator lever arm, which in turn governs the field of the booster and thereby the discharge from storage battery.

In case of emergency, such as a shutdown on transmission line, the battery is immediately thrown directly across the railway bus and keeps the cars in operation long enough to allow the operators to get the railway machines back on the line again. On one or two occasions when the battery has been directly across the railway bus, discharges as high as 9000 amp. have been observed by the operators.

The battery is kept floating on the line continually and is of great assistance on peak loads. The charging of the battery is done mostly at night when cars are not in operation.

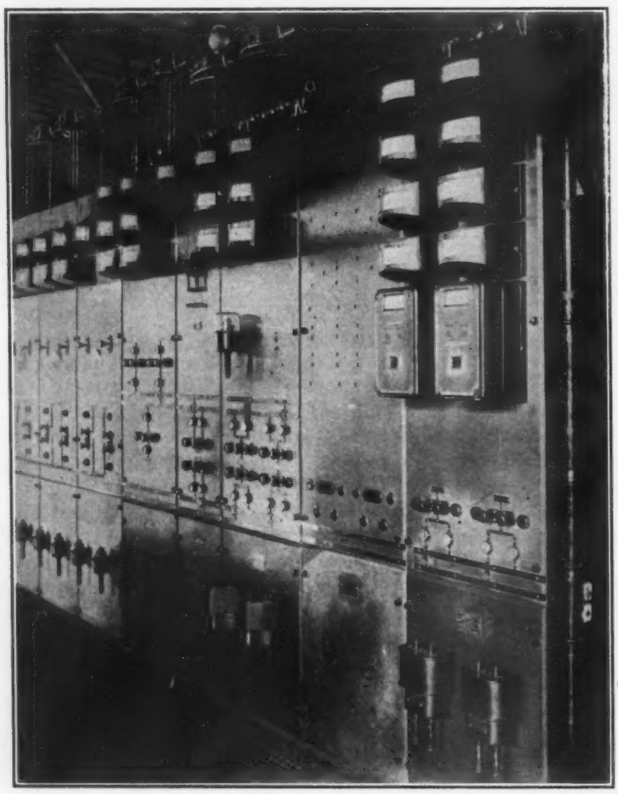


FIG. 5—CONTROL PANELS FOR INCOMING LINES AND OUTGOING UNDERGROUND FEEDERS IN ANNEX TO MILL STREET SUBSTATION FOR HANDLING CEMENT MILL LOAD

Arrangements Made to Serve Cement Company

When the Winnipeg Electric Railway Company obtained a contract for a large block of power to be supplied to the Canada Cement Company, provision had to be made for satisfactorily handling the load. After an investigation it was decided to tap the 60,000-volt transmission line and step down to 22,000 volts for transmission to the cement company. To accomplish this a new addition, known as the transformer annex, was made to the Mill Street substation. This is a two-story brick building resting on a concrete foundation and tied to the main building. The lower floor contains the transformers, while the switching apparatus is mounted on the second floor. Provision is made for nine single-phase transformers, each resting on two rails mounted in concrete bases. A 12-ton transformer truck operating on a track at right angles is used as a transfer table.

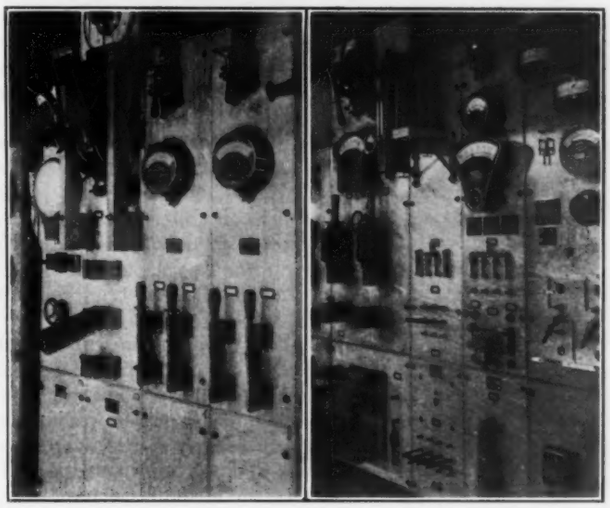
The two 60,000-volt lines enter the second floor at opposite sides of the building and tie into the two buses mounted on the ceiling. These feed either of the two transformer banks, each composed of three 1000-kva., 60,000/22,000-volt, oil-cooled transformers. The secondaries of the latter tie into either of the two low-tension buses mounted on a reinforced concrete barrier running along the center of building and directly over the 22,000-volt oil circuit breakers. Both high and low-tension buses are constructed with 0.5-in. copper tubing.

The five 60,000-volt oil switches are of the solenoid operated type, two controlling the incoming lines, two for the transformer banks and one for the bus tie. A sixth switch is mounted in the Mill Street substation, connecting the high-tension bus of the annex to that of the substation in order to supply the annex from the steam turbine plant in case of breakdown.

Three-core, lead-covered, paper-insulated cable is used to connect the low-tension side of transformer banks to the oil switches. This feature allows greater protection to life as well as occupying less space in the building. All oil switches are guarded by wire framework, on which is fastened the names of the

switches. All piping for control wires, lighting fixtures, for three gas fixtures, and bolts for insulator supports were set in forms before concrete was poured.

Special cast-iron caps, with 5/8-in. tapped hole in the top, were designed to be cemented on top of 70,000-volt Ohio Brass insulators for the purpose of securing them to the ceiling. Pieces of 1-in. piping of desired length were secured to the pins of the insulator in order to support the copper tubing. The ends of this pipe were filed to properly fit against the tubing, and a 3/16-in. hole drilled through the pipe permitted the use of copper tie wires to bind the tubing securely to the pipe. All control wires for the annex equipment are run in iron conduit to the five slate panels in the Mill Street substation. All circuits are protected by time limit overload relays. Red, green and white lights indicate the condition of the oil switches from which bus the lines are being fed. An alarm bell is supplied for each switch in order that the opening of the same may immediately notify the operator.



FIGS. 6 AND 7—MAIN CONTROL PANELS FOR BATTERY AT END OF FEEDER PANELS AND CONTROL PANELS FOR BOOSTER SET AND CARBON PILE REGULATOR

UNDERGROUND SYSTEM

Since 22,000-volt aerial transmission lines are prohibited within the city limits, underground transmission had to be provided. This called for the construction of a duct line from the Mill Street substation to the St. James substation, a distance of 3.25 miles. Two 22,000-volt, three-core, 1/0 paper-insulated, lead-covered cables pass through eighty manholes and contain eighty joints each. A slab of asbestos 1 ft. by 2.5 ft. secured over the top of each joint protects it from other cable burns, and anything falling from ceiling of manhole. It also prevents men from stepping on the joint.

The three high-tension ducts are separated from all other ducts by a 4-in. layer of concrete and in large manholes by a tier of brick extending about 6 in. out from the edge of the duct line. The feeders passed through the St. James Subway and over Omands Creek and involved special construction. The cables were pulled into two 4-in. conduits, supported on the street car trestle bridge over the creek and laid in concrete in bottom of the subway. These conduits extend to the manholes on each side of the subway. Entrance to the St. James substation, located at the western city limits, was made underground and all 22,000-volt apparatus installed during 1913.

The St. James substation is a one-story brick structure on a concrete foundation built in the year 1909. The equipment in the substation includes two transformer banks, two motor generator units for railway service, two mercury arc rectifiers and one automatic voltage regulator.

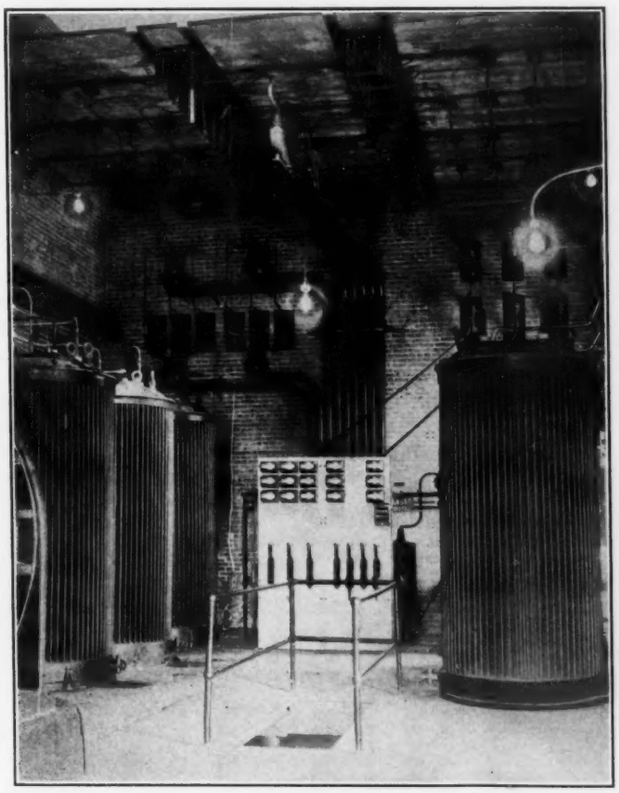


FIG. 8—ST. JAMES SUBSTATION FROM WHICH 22,000-VOLT LINES LEAD TO CEMENT WORKS AND AGRICULTURAL COLLEGE

FIG. 9 — WOOD POLE 22,000-VOLT TRANSMISSION LINE TO CEMENT WORKS AND AGRICULTURAL COLLEGE

Two 22,000-volt incoming lines tie on to either one of two buses mounted on the ceiling, either of which feeds the two transformer banks and outgoing line to the Canada Cement Company and Agricultural College.

Each transformer bank consists of three 700-kva., 22,000/2200-volt, oil-cooled Canadian General Electric transformers. All 22,000-volt, oil-circuit breakers are of the General Electric K-21 hand-operated type, mounted in the basement and controlled from the two slate panel switchboards on the main floor. Directly behind the switchboard is mounted the electrolytic lightning arrester for the outgoing 22,000-volt transmission line.

The outgoing 22,000-volt transmission line runs south on a 45-ft. wooden pole line. The 3/0 stranded copper cables have a triangular spacing of 3 ft. The top one-pin arm is rather uncommon, but has given very good satisfaction. At a point 3 miles south of the St. James substation the line branches through two sets of outdoor disconnecting switches to the Canada Cement Company and to the Agricultural College. All insulators in the neighborhood of the cement works are of the Thomas 60,000-volt type due to the large amount of cement dust present in the air. These insulators were formerly used on the transmission line.

SUBSTATION AT CEMENT WORKS

The substation at the Canada Cement Works is a one-story concrete building, divided into a transformer or high-tension room and a switchboard room. The former contains the Winnipeg Electric Railway Company's equipment and the latter is used by the cement company. The railway company's equipment consists of two banks of transformers, high and low-tension oil switches and a two-panel switchboard. Each bank is composed of three 750-kva., 22,000/600-volt, oil-cooled transformers. The switching equipment is of the remote-control, hand-operated type of Canadian Westinghouse design.

Current is metered to the consumer from the 600-volt bus, which extends through the dividing wall to the cement company's bus. Multigap lightning arresters are installed in this station.

The Agricultural College branch of the transmission line extends about 4.5 miles beyond the cement works. on a 45-ft. wooden pole line supporting No. 1 solid copper cables with a 3-ft. triangular spacing. Part of this line parallels the suburban car line and the poles support the trolley wire as well as the transmission line.

The 22,000-volt line enters the Agricultural College powerhouse through standard Ohio brass bushings and by means of disconnecting switches and oil circuit breakers, supplies three 500-kva., 22,000/2200-volt, oil-cooled transformers. Electrolytic arresters protect this end of line. Current is delivered to the college at 2200 volts through a 600-amp., 6600-volt, remote-control, type B circuit breaker, disconnecting switches and current measuring equipment. One panel controls both high and low-tension switches. All apparatus was supplied by the Canadian Westinghouse Company. A second panel controls an outgoing single-phase, 2200-volt feeder supplying current to the municipality of St. Norbert for domestic lighting.

The underground conduit system, a part of which is herein described, was installed by G. M. Gest of New York City. The storage battery was installed by the Electric Storage Battery Company and the underground cables by the Standard Underground Cable Company. The Canadian General Electric Company furnished most of the switching equipment.

COST OF RURAL LINES AND REVENUE THEREFROM

Analyses of Investments in Several Lines Serving Sparsely-Settled Districts and Revenues Therefrom Show Need of Inexpensive Construction

As generally contended by electric service companies and forcibly brought out by the accompanying data, service can be supplied to sparsely-settled districts at a profit only by employing inexpensive line construction. There is another alternative, that of charging higher rates, but usually rates are already as high as the business will bear or as high as feasible. Therefore, any specifications which will impose stringent requirements on such lines will tend to deter developments.

The accompanying data were presented by the committee on overhead lines at the recent N. E. L. A. convention to show that many minor distribution lines in sparsely-settled districts bring in little if any return on the investment they represent. While these data are not extensive they represent the economics of lines of this character. In addition they indicate the cost of constructing similarly equipped lines. More figures were not given for Eastern territories because few lines serving low-density loads are installed there, it being the practice of many of the larger companies not to install lines unless the revenue in sight is sufficient to make the lines profitable. The negative return on the investments represented in many cases were not shown to discourage supplying service to thinly populated territories but to point out that any legislation that requires more costly line construction may have a deterrent influence on extensions of this type. Unfortunately the data refer to lines which have been constructed during the last year or two so that the figures do not show the final financial status, since the gross revenue from a line will increase year by year if new business is developed along it. This increase, however, will be partially offset by the carrying charges on additional investment, in service connections and equipment and the increased operating and maintenance charges.

In preparing these tables interest was assumed as 7 per cent in all cases, although it is probable that the

CLASSIFICATION OF LINE INVESTMENTS* FOR MINOR DISTRIBUTION LINES

	Eastern Washington	Western Washington	Central Washington	Southern California	Central California		Idaho	Utah	Illinois	Central New York	Average
Number of lines	7	6	13	4	58	.....	3	5	4	2	.....
Total length	100.5	3.8	40.4	150.5	109.4	100.0	29.4	52.8	31.3	12.0	630 Tot
Cost per mile:											
Right-of-way	$5	.....	$32	$29	.....	.....	$30	$1	$80	$208	.....
Physical cost exclusive of conductors	745	$585	317	534	.....	.....	524	500	835	1654	.....
Conductors	280	349	181	694	.....	.....	353	228	847	478	.....
Services, transformers, street lighting, equipment, etc	193	558	228	695	.....	.....	424	197	513	228	.....
Overhead costs	122	298	177	33	.....	.....	69	74	210	182	.....
Total	$1,345	$1,790	$935	$1,985	$860	$1,560	$1,400	$1,000	$2,485	$2,750	$1,610

*See full page table for equipment of lines.

CONSTRUCTION AND LOAD DATA, COST AND RETURNS OF SMALL DISTRIBUTION LINES

Location of System	Class of Service	Number of Years	Line Data: Length, Miles	Voltage	Poles	Span, Feet	Primary Conductors	Cost per Mile	Load Data: Gross Revenue per Mile	Annual Kw.-hr. per Mile	Cents per Kw.-hr.	Returns and Expense in Per Cent of Cost: Gross Revenue, per Cent	Interest, per Cent	Depreciation, per Cent	Operation Maintenance and Taxes, per Cent	Cost of Power, per Cent	Total Expense, per Cent	Net Profit, per Cent
Eastern Washington																		
(1)	Light and power	1	31.39	6,900	8"35'	150	3—No. 3 al	$1,105	$169	1,970	8.6	15.4	7	6.9	4.0	6.1	24.0	− 8.6
		2			7"40'	125	3—No. 8		183	2,050	8.9	16.5	7	6.9	4.6	6.6	25.1	− 8.6
(2)	Light and power	1	19.65	6,900	8"35'	200	3—No.4 iron	1,150	184	2,510	7.3	16.0	7	7.1	4.6	6.4	25.1	− 9.1
		2			7"40'	125	3—No. 8		211	3,040	7.0	17.9	7	7.1	5.2	7.4	26.7	− 8.8
(3)	Light and power	1	25.45	6,900	8"35'	150	3—No. 3 al	1,225	171	1,235	13.8	14.0	7	6.9	3.6	5.6	23.1	− 9.1
		2			7"40'	125	3—No. 8		174	1,550	11.2	14.2	7	6.9	3.7	5.7	23.3	− 9.1
(4)	Lighting	1	1.25 (ap)	2,300	40'	120	3—No. 6	1,470	152	1,520	10.0	10.3	7	5.4	0.6	3.0	16.0	− 5.7
		3							152	1,520	10.0	10.3	7	5.4	0.6	3.0	16.0	− 5.7
(5)	Lighting	1	2.5 (ap)	2,300	40'	120	3—No. 6, 2	1,975	307	3,840	8.0	15.5	7	6.5	3.0	1.2	17.7	− 2.2
		3							375	4,680	8.0	18.9	7	6.5	3.0	1.4	17.9	+ 1.0
(6)	Light and power	1	7.5	2,300	35'	150	3—No. 0, 00	1,750	7	93	8.0	0.4	7	5.1	2.9	0.1	15.1	−14.7
		3							10	124	8.0	0.5	7	5.1	2.9	0.1	15.1	−14.6
(7)	Light, power and irrigation	1	11.75 (ap)	2,300	40'	120	3—No. 6, 2	2,045	274	3,420	8.0	13.4	7	6.2	2.6	1.0	16.8	− 3.4
		3	1.0	2,300	Undergr	ou	nd 3—No. 0		274	3,420	8.0	13.4	7	6.2	2.6	1.0	16.8	− 3.4
Total		1	100.49					$1,345	$177	1,970	9.0	13.2	7	5.8	3.6	4.2	20.6	− 7.4
		2.6							$189	2,200	8.5	14.1	7	5.8	3.8	4.5	21.1	− 7.0
Western Washington																		
(1)	Lighting	1.5	0.66	220	8"30'	146		$1,180	$115	1,250	9.1	9.6	7	6.0	7.0	0.8	20.8	−11.2
(2)	Lighting	1.5	1.44	13,800	9"40'	164	2—No. 6	1,468	396	4,750	8.3	27.0	7	6.9	18.8	2.8	35.5	− 8.5
(3)	Lighting	1.5	0.5	13,800	9"40'	142	2—No. 6	2,900	475	8,600	5.5	16.4	7	5.4	7.4	2.3	22.1	− 5.7
(4)	Large farm	1.5	0.58	13,800	9"40'	138	2—No. 6	2,290	845	18,800	4.5	37.0	7	7.4	3.4	7.0	24.8	+12.2
(5)	Lighting	1.5	0.38	13,800	9"40'	143	2—No. 6	1,680	166	2,330	7.2	10.0	7	6.8	5.7	1.1	20.6	−10.6
(6)	Farming	1.5	0.25	2,200	9"45'	140	2—No. 6	1,990	125	1,520	7.9	6.1	7	6.6	5.0	0.6	19.2	−13.1
Total		1.5	3.81					$1,790	$385	6,350	6.1	21.5	7	6.6	9.8	3.0	26.4	− 4.9
Central Washington																		
(1)	Irrigation	1	7.2	6,600	35'	250	3—No. 6 & 8 & No. 8 cc	$880	$143	6,150	2.3	16.3	7	6.5	7.3	3.6	2.44	− 8.1
(2)	Irrigation	1	8.27	6,600	*35'	225	3—No. 8 cc *	850	229	9,850	2.3	26.9	7	6.9	9.4	5.6	28.9	− 2.0
(3)	Irrigation	1	0.73	6,600	35'	245	3—No. 8 cc	935	232	6,480	3.6	24.8	7	7.3	11.3	3.4	29.0	− 4.2
(4)	Irrigation	1	2.6	6,600	35'	205	3—No. 8 cc & No. 8 iron	1,065	58	2,470	2.4	5.5	7	7.0	3.2	1.1	18.3	−12.8
(5)	Irrigation	1	6.35	6,600	35'	240	3—No. 3 & 2 al	825	240	11,300	2.1	29.2	7	5.2	9.2	6.6	28.0	+ 1.2
(6)	Light and power	1	9.0	6,600	35'	225	3—Small al	976	237	5,100	4.6	24.2	7	5.7	11.5	2.5	26.7	− 2.5
(7)	Lighting	1	1.8	6,600	35'	140	2—No. 8 & 6 & No. 8 iron	1,290	302	3,320	9.1	23.4	7	6.1	14.4	1.2	28.7	− 5.3
(8)	Light and irrigation	1	1.18	6,600	35'	250	3—No. 8	1,015	148	1,625	9.1	14.6	7	7.1	8.0	0.8	22.9	− 8.3
(9)	Irrigation	1	0.23	6,600	35'	250	3—No. 6	2,340	500	18,450	2.7	21.4	7	7.0	8.9	3.7	26.6	− 5.2
(10)	Power	1	0.67	6,600	35'	176	3—No. 8 cc	1,090	119	321	3.9	11.3	7	7.4	7.4	0.2	22.0	−10.7
(11)	Irrigation	1	1.37	6,600	30'	170	3—No. 6	893	244	9,370	2.6	27.4	7	5.8	10.4	5.0	28.2	− 0.8
(12)	Irrigation	1	0.52	2,300	35'	195	3—No. 8	1,140	488	32,800	1.5	43.5	7	6.8	9.2	14.1	37.1	+ 6.4
(13)	Irrigation	1	0.52	6,600	*35'	145	2—No. 8	870	127	458	2.8	14.6	7	7.0	8.6	0.2	22.8	− 8.2
Total		1	40.44					$935	$208	7,330	2.9	22.3	7	6.2	9.3	3.8	26.3	− 4.0
Southern California																		
(1)	Light and irrigation	1	32.68	2,400	*35'	150	4 av.—No. 6*	$2,870	$432	7,350	5.9	20.2	7	5.8	6.5	2.6	21.9	− 1.7
			35.84	15,000	40'	250	3—No. 4	1,450										
(2)	Light and irrigation	1	4.0	2,400	*35'	150	3—No. 6, 4	2,080										
			40.2	10,000	*35'	220	3—No. 6, 5, 4		170	6,340	2.7	9.1	7	5.8	5.1	2.5	20.4	−11.3
			18.2	50,000	*35'	305	3—No. 6	1,390										
(3)	Lighting	1	4.38	2,400	40'	200	3—No. 4	1,680	103	1,260	8.2	6.1		5.1	3.5	0.6	16.2	−10.1
(4)	Light and irrigation	1	0.26	2,400	40'	250	3—No. 6-4	1,840	460	20,600	2.2	25.0	7	6.1	6.0	8.4	27.5	− 2.5
			14.89	15,000														
Total		1	150.45					$1,985	$317	8,090	3.9	15.9	7	5.8	5.8	3.1	21.7	− 6.8
Central California																		
Total	†	1	109.4	....	.....	..	.....	$860	$160	....	..	18.6	7	6.0	13.0	.....	26.0	7.4
	††	2	100.0					$1,560	$310			19.9	7	6.0	23.1		36.1	16.2
Idaho																		
(1)	Light, power and irrigation	1	5.0	2,300	7"35'	200	3—No. 6	$1,580	$378	9,800	3.9	23.9	7	6.0	7.1	10.2	30.3	− 6.4
			14.5	11,000	7"35'	200	3—No. 4											
(2)	Light, power and irrigation	1	6.9	11,000	7"35'	250	3—No. 6 iron	870	174	3,480	5.0	20.0	7	7.2	5.9	8.5	28.6	− 8.6
(3)	Light and power	1	3.0	2,300	7"35'	150	3—No. 6	1,430	698	8,000	8.7	48.8	7	6.5	6.4	110.0**	129.9	−81.1
Total		1	29.4					$1,400	$363	8,140	4.5	25.9	7	6.2	6.8	20.4	40.4	−14.5
Utah																		
(1)	Mainly light	1	2.5	2,300	7"30'	175	3—No. 6	$626	$160	1,395	11.4	25.5	7	6.1	8.7	7.9	29.7	− 4.2
(2)	Light, power and irrigation	1	8.3	2,300	7"35'	200	3—No. 6	1,060	144	3,580	4.0	13.6	7	6.1	1.5	4.7	19.3	− 5.7
			7.6	11,000	7"35'	200	3—No. 4											
(3)	Mainly light	1	6.0	2,300	7"30'	200	3—No. 6	911	184	1,025	17.9	20.2	7	6.4	2.8	5.1	21.3	− 1.1
(4)	Mainly light	1	9.5	11,000	7"35'	250	3—No. 6	1,140	128	1,230	10.4	11.2	7	6.5	3.7	3.3	20.5	− 9.3
(5)	Mainly light	1	18.9	11,000	7"35'	250	3—No. 6 iron	960	106	1,060	10.0	11.0	7	6.9	2.7	4.8	21.4	−10.4
Total		1	52.8					$1,000	$133	1,860	7.1	13.3	7	6.5	2.7	4.6	20.8	− 7.5
Illinois																		
(1)	Light and street light	1	7.75	4,600	7"30'	100	3—No. 6	$2,170	$189	1,645	11.5	8.7	7	6.4	2.9	8.9**	25.2	−16.5
		4		2,300					220	1,870	11.7	10.1	7	6.4	3.8	6.3	23.5	−13.4
(2)	Light and street light	1	5.75	33,000	7"30'	120	3—No. 2	3,940	218	1,860	11.7	5.5	7	5.5	3.0	0.9**	16.4	−10.9
		2		2,300					271	2,320	11.7	6.0	7	5.5	3.2	1.1	16.8	−10.8
(3)	Light and street light	1	4.0	2,300	7"30'	100	3—No. 4	2,010	260	2,825	9.2	13.0	7	5.9	5.2	2.5**	20.6	− 7.6
		2							279	2,980	9.4	13.8	7	5.9	5.4	2.7	21.0	− 7.2
(4)	Light and street light	1	13.75	4,000	7"30'	125	4—No. 4	2,190	254	2,150	11.8	11.6	7	5.6	3.0	7.5**	23.1	−11.5
		3							251	2,210	11.4	11.4	7	5.6	3.3	7.2	23.1	−11.7
Total		1	31.25					$2,485	$232	2,050	11.3	9.4	7	5.5	3.2	5.3**	21.0	−11.6
		3 av							$250	2,370	11.0	10.1	7	5.5	3.6	4.8	20.9	−10.8
Central New York																		
(1)	Lighting	1	6.2	2,300	6½**30'	101	3—No. 4*	$2,200	$263	2,250	11.7	12.0	7	6.6	3.3	3.5**	20.4	− 8.4
		2			Note A				279	2,325	12.0	12.7	7	6.6	3.3	3.8	20.7	− 8.0
(2)	Lighting	1	5.8	2,300	6½**35'	141	3—No. 4	3,350	314	2,340	13.5	9.4	7	6.5	2.8	2.6**	18.9	− 9.5
		2							325	2,345	13.9	9.7	7	6.5	2.8	2.6	18.9	− 9.2
Total		1	12.0					$2,750	$287	2,290	12.5	10.5	7	6.6	3.0	3.0**	19.6	− 9.1
		2							$300	2,330	12.8	10.9	7	6.6	3.0	3.1	19.7	− 8.8
Average		1.6	630 Total					$1,610	$262	....	..	17.2	7	6.1	12.8	.....	25.9	8.7

*Principally of this size. **Steam power. †58 lines. ††Irrigation service chiefly—average of typical wet and dry years. ¶See itemized costs.
Note A: About ⅗ of the poles on this line are of joint telephone ownership.

average rate at which money was secured was over this amount. Depreciation was comprised of 8 per cent for lines exclusive of conductors, 2 per cent for conductors, and 8 per cent for services, transformers and street lighting equipment. The values for operation and maintenance were taken from plant records, and where taxes were not included they were estimated at 1.5 per cent. The cost of power was included in the records submitted except in the cases of the southern California group and the first of the central California group for which an estimated cost of three-fourths of 1 cent per kilowatt-hour at the point delivered to the transmission line was assumed.

The ten groups of lines analyzed have an average length of service of 1.6 years and show an average deficit equal to 8.7 per cent of the investment or 50 per cent of the gross revenue. They can, therefore, be placed on a profitable basis only by increasing the rates (not feasible) on the same load or doubling the load without extending the lines. If it should take too long to double the load, however, the deficit accruing during development would be difficult to remove. It may be pointed out that several lines yielding a gross revenue of less than $200 a mile show a smaller deficit than the average because of the lower cost of construction. This is due to the use of long spans, small conductors (in some cases iron), and light construction, the initial cost, including services, being usually little if any greater than $1,000 per mile.

While the accompanying data seem to indicate that there are no returns from any minor distribution lines, indirect benefits may accrue from the general development afforded, the good-will secured from willingness to serve and the sale of otherwise surplus power.

Graphic Analyses of Managerial Problems

Instances Where Curves and Diagrams Are of Great Practical Value in Facilitating the Solution and Understanding of Problems of Investment, Revenue and Expense

BY EDWIN D. DREYFUS

ALTHOUGH graphic analyses and graphic exhibits are frequently used by engineers and have been discussed in reference books, curves and "linear laws" are not generally employed as extensively as their usefulness justifies. To appreciate the inherent advantages of linear relationships, serious study and thoughtful attention must be given the matter, in order that the perspective and inter-relation displayed by a family or group of interdependent curved and rectangular lines may be fully grasped. The eye and mind are readily trained to operate in this realm consciously at first and later intuitively, with the result that the business man and engineer will acquire a power of judgment and insight in making business introspection and prophetic analyses of a more accurate and certain nature than obtainable in any other way.

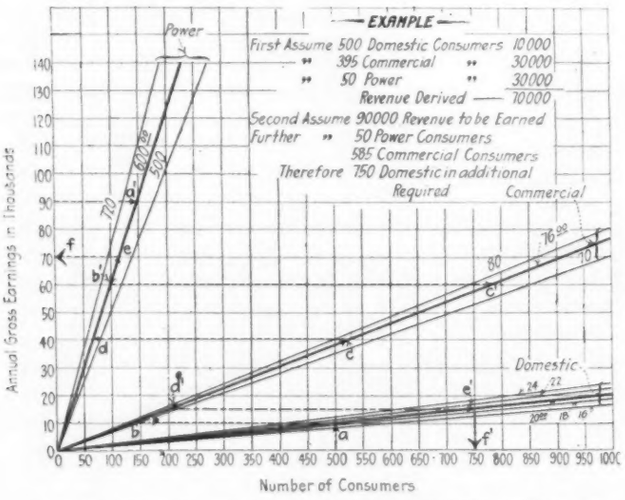


FIG. 1—REVENUE CHART FOR VARIOUS COMBINATIONS OF DOMESTIC, COMMERCIAL AND POWER CONSUMERS

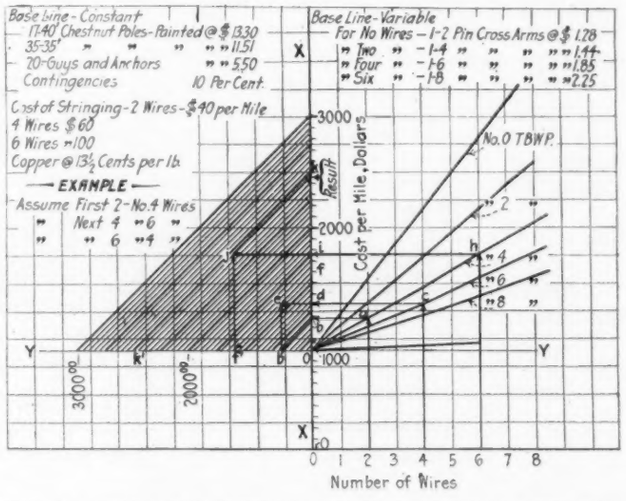

Base Line - Constant
17-40' Chestnut Poles-Painted @ $ 13.30
35-35' " " " " " 11.51
20-Guys and Anchors " " 5.50
Contingencies 10 Per Cent
Cost of Stringing-2 Wires-$40 per Mile
4 Wires $60
6 Wires 100
Copper @ 13½ Cents per lb.
Base Line-Variable
For No Wires — 1-2 Pin Cross Arms @ $ 1.28
" Two " — 1-4 " " " " " 1.44
" Four " — 1-6 " " " " " 1.85
" Six " — 1-8 " " " " " 2.25
EXAMPLE
Assume First 2-No.4 Wires
" Next 4 " 6 "
" " 6 " 4 "
No.0 TBWP.
Cost per Mile, Dollars
Number of Wires

FIG. 2—CHART FOR DETERMINING COST OF POLE LINE CONSTRUCTION WITH DIFFERENT COMBINATIONS OF CIRCUITS

In various branches of mathematics, graphic construction of formulas provides a very instructive study, and in astronomy, in dynamics, and in many of the practical sciences this means furnishes a most profitable guide to the solution of important technical problems. While business operations do not ordinarily occur with sufficient regularity to permit their results being reduced to formulas or otherwise being represented by fixed conditions, such as a series of curves and lines would convey, averages in the usual run of business do, however, bear relations in such ways that with the aid of diagrams important deductions may be made.

On account of the diverse interests met with on every hand, and the great complexities of modern business and engineering, every facility is required to open up avenues for a quick perception of new situations that may be confronted. Nothing is so illuminating as a set of properly proportioned diagrams. Business in the past has contented itself in the main with tabular presentation of the trend of its affairs, and habit is no mean force to reckon with. However, graphics have such practical significance in engineering work when extensively used that the regular routine of related business is made much more intelligible by the adoption of this important aid. In addition to the significance of graphics in analytical work, it is likewise a valuable aid to the memory. A picture is manifestly more readily retained in mind than a description of the same subject, no mat-

ter how vividly it may have been expressed. A pictorial or diagrammatic illustration usually produces a firmer and more lasting impression than any composition of words or tabulation of figures, however, well they may be arranged or set forth.

The following exhibits taken at random are illustrations of the employment of graphics and emphasize their utility in pursuing a line of reasoning and in expediting the reaching of conclusions on certain dubitable and unsolved problems. The examples do not begin to reveal the wide use to which diagrams may be applied and are merely unique cases, in which it is believed much work was compassed within notably small space.

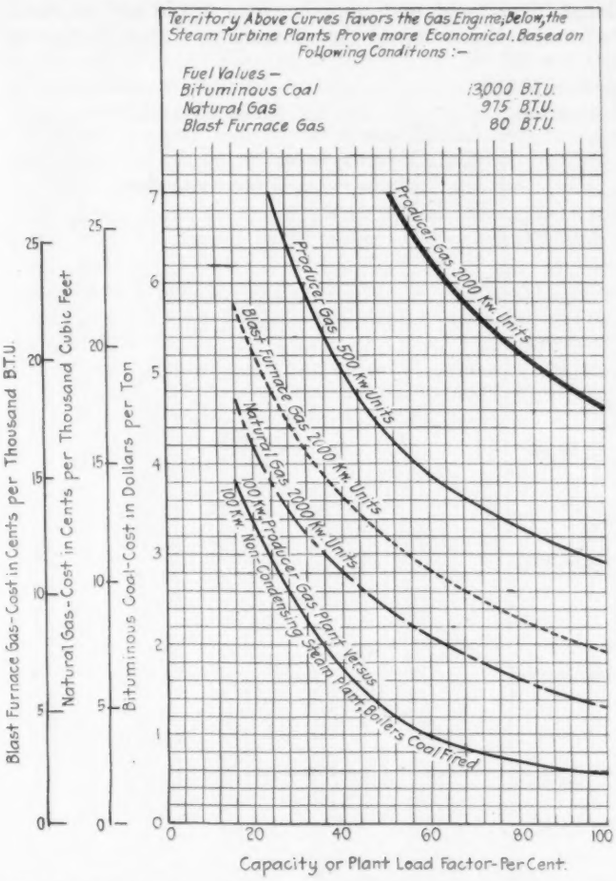

Territory Above Curves Favors the Gas Engine, Below, the Steam Turbine Plants Prove more Economical. Based on Following Conditions :—
Fuel Values —
Bituminous Coal 13,000 B.T.U.
Natural Gas 975 B.T.U.
Blast Furnace Gas 80 B.T.U.
Producer Gas 2000 Kw. Units
Producer Gas 500 Kw. Units
Blast Furnace Gas 2000 Kw. Units
Natural Gas 2000 Kw. Units
100 Kw. Producer Gas Plant Versus Non-Condensing Steam Plant, Boilers Coal Fired
Blast Furnace Gas-Cost in Cents per Thousand B.T.U.
Natural Gas-Cost in Cents per Thousand Cubic Feet
Bituminous Coal-Cost in Dollars per Ton
Capacity or Plant Load Factor-Per Cent.

FIG. 3—BALANCE OF TOTAL GENERATION COSTS IN GAS AND STEAM PLANTS WITH VARIABLE FUEL PRICES AND LOAD FACTORS

Example I.—There are instances where speedy substantiating or else disproving of contentions may have a far-reaching effect. Suppose a witness is placed upon the stand in behalf of a company opposing before a public service commission the granting of a competitive franchise. Assume also that the witness is qualified and prepared to give testimony on the condition of saturation of business of the territory involved. The average present revenue per consumer of the different classes (domestic, commercial and power) of the existing company should have been secured first, and likewise a complete canvass of all prospective consumers should have been made. If, then, the petitioners should claim that 500 domestic, 395 commercial and fifty power consumers were to be obtained, quick calculation of the probable gross revenue is possible, as will be seen by following the dotted guide lines *a, b, c, d, e, f*, reaching an aggregate of $70,000.

As an illustration, start at (*a*) with 500 domestic customers, from which a $10,000 revenue would be secured, the point of intersection of commercial diagonal line with the $10,000 line of ordinate indicates an equivalent of 125 commercial consumers, to which is to be added the 395 already specified which, by ready mental operation, shows 520 commercials, which extended to (*c*) sums up to $40,000 revenue. Similarly an intersection with the power diagonal at (*d*) determines an equivalent of sixty-six power consumers (approximate), and adding the fifty already given makes a total of 116 (*e*), which corresponds to $70,000 revenue. Now by reversing the process somewhat, and assuming that $90,000 annual revenue is essential for the security of a "paralleling" investment, and, further, that it had been so far claimed that fifty power consumers and 585 commercials could be booked, by employing the diagram, and as indicated by guide lines *a′, b′, c′, d′, e′, f′*, it is at once apparent that 750 domestic consumers in addition would be necessary to provide the required $90,000 revenue. (The method of subtraction and division on the chart is the opposite of that just described for multiplication and addition, as will be evident.) The impossibility of attaining the $90,000 revenue would promptly prove the venture to be unprofitable. Numerous other conditions could be likewise worked out rapidly when charts showing graphical relations are employed.

Example II.—In such cases as the above, numerous other diagrams could be developed to enable quick analysis and estimating of the amounts involved in a proposed second utility's system, and Fig. 2 is a striking example. Approximate costs of the overhead distribution system could be figured immediately, as the extent of the line to be built was stated. An assumed mile of two No. 4 wires, four No. 6 and six No. 4 might be taken for illustration as being under discussion. The pole line cost, to some extent, is practically the same, irrespective of the number of wires strung. Then by

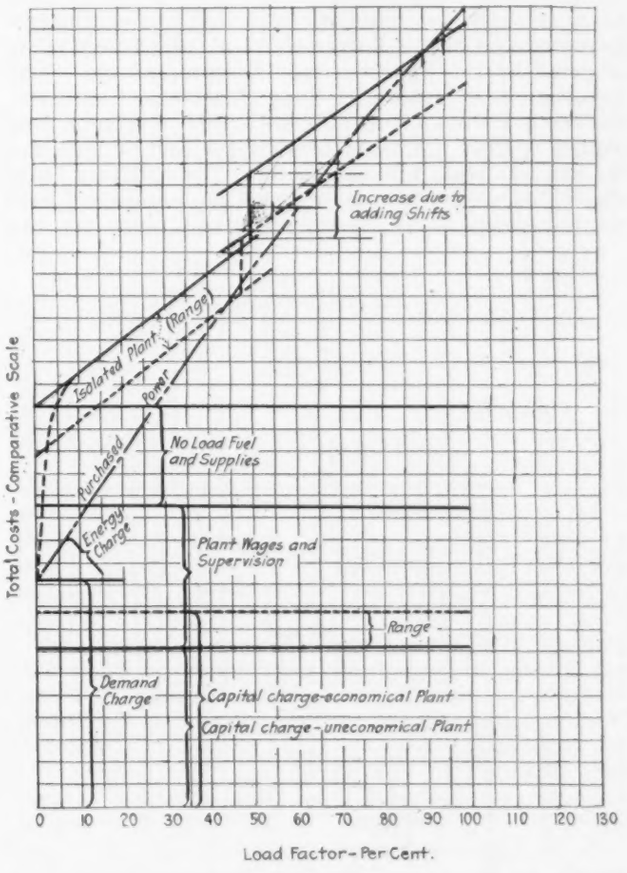


FIG. 4—DIAGRAMMATIC COMPARISON OF PURCHASED POWER AND ISOLATED PLANT COSTS

equilateral triangulation centered about the origin or axis O, the results are obtained for any combination of wires.

For example, assume the equipment to be two No. 4, four No. 6 and six No. 4 wires. For two No. 4 wires as at (a) a value at (b) is found on the vertical dollar scale (OX), or by 45 deg. diagonals the same value at (b') on the identical horizontal dollar scale (OY). To add for four No. 6 at (c), which corresponds to (d) on the OX scale, and avoid duplicating cost of common pole supports, the line (cd) is projected horizontally until it intersects the vertical line $(b'e)$ and as will be observed on close inspection the chord, $(b'\ e)$ is the increment of cost due to the four No. 6 wires. By projecting the point (c) on the diagonal lines to either (f) on scale (OX), or (f') on scale (OY), the cost of the line is obtained. Proceeding in the same way to add the additional six No. 4 wires, we take (h) and project through (i) to the intersection of $(f'j)$, $(f'j)$ being the increment due to the six No. 4 wires, and running diagonally from (j) to either (k') or (k) the final result for this example is derived. Any scheme of wire lines may be thus speedily solved for cost by referring to such a chart.

Example III. About five years ago the economic position of the gas power plant was not fully appreciated. Owing to the difference in investment and operating costs between the steam turbine and gas power plants, the respective size, load factor and cost of fuel influenced their comparative ultimate economies. An exhaustive study was made of the subject and conclusions as reproduced in Fig. 3 were obtained, which were given in detail by the writer in the 1911 proceedings of the Association of Iron and Steel Electrical Engineers. Curves are drawn for different sizes of plants, and plotted against the ordinate scale for cost of fuel and the abscissa scale for load factor. The territory lying above the respective curves shows the economical field for the gas-producer power plant and below for the steam turbine plant. In this way the results of a variety of conditions are concentrated in one diagram in what is believed to be an entirely clear manner that permits ready interpretation.

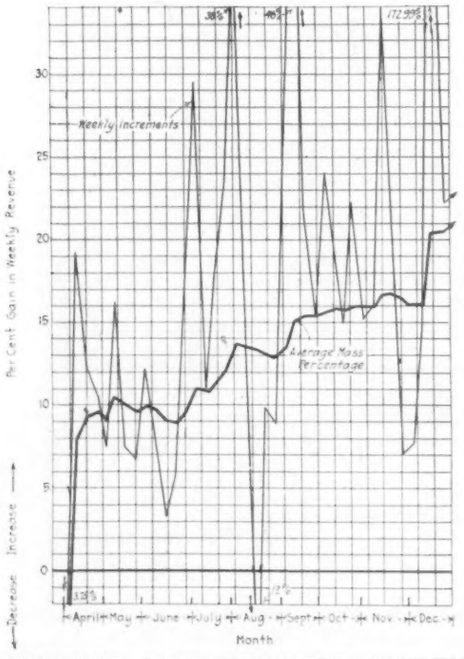


FIG. 5—AN ESTIMATE OF NET WEEKLY INCREMENTS IN REVENUE FROM LIGHT AND POWER SERVICE FOR A SYSTEM

Example IV. The diagram of Fig. 4 brings out the relative situation of isolated power plant costs versus purchased energy under certain assumed conditions. The discussion here centered about the question as to whether it was advisable to install machinery to minimize the peak load created on the power company's system. It would appear from this chart that the additional investment and complications would not be justified under the assumed circumstances. This discussion is amplified by the writer on page 82 of the 1915 proceedings of the American Institute of Electrical Engineers. It should convey a firm conception of the relative tendencies of the two sources of power.

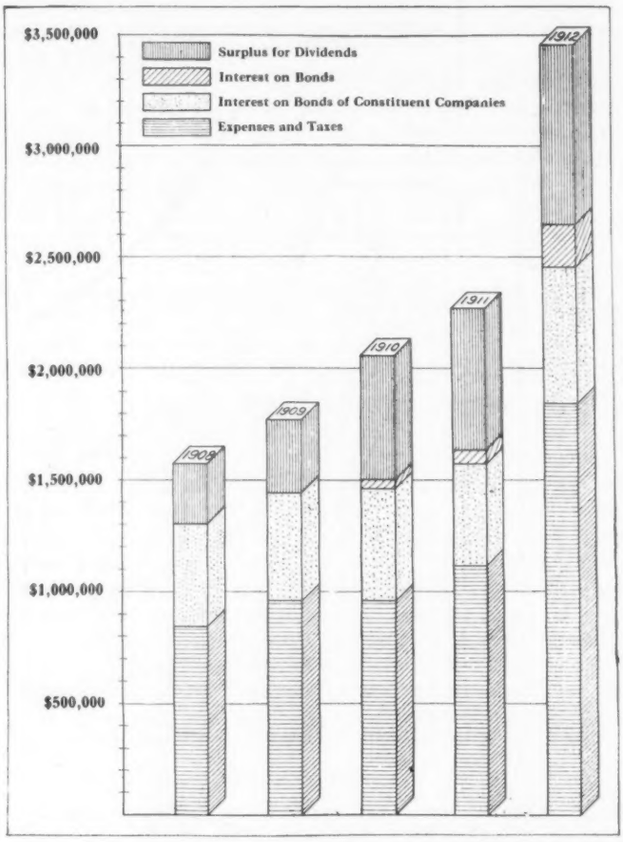


FIG. 6—PICTORIAL DIAGRAM SUITABLE FOR REPRESENTATION OF CERTAIN DATA IN THIS CASE COMPARATIVE EARNINGS

Example V. In Fig. 5 a simple case of plotting fluctuations of business returns from week to week is presented, with the addition, however, of an auxiliary curve which shows the accumulated or mass average and brings out clearly the trend either in the direction of an improvement or a decline in results.

Example VI. Often a pictorial diagram or chart such as shown in Fig. 6 produces a quicker perception of the conditions than the average mind may obtain from a mere line diagram. Variations in charts of this kind can be devised in great numbers according to nature of information and features it may be desired to illustrate.

The sporadic illustrations given here carry no other value than a demonstration of the practical uses of a graphical presentation of facts both simple and complex. By reflecting on the matter it will be appreciated that this particular article will be remembered longer by reason of the charts it contains than would be true if written accounts, no matter how well composed, had been relied upon. This entire idea is merely a reversion to elementary object lessons, but evidently of more intricate nature as necessitated by the higher order of the problems undertaken.

DETERMINING FIRST COST OF EDISON TUBE SYSTEM

An Analysis of Capital Expenditure and Discounts for the Edison Tube Distribution System from an Appraisal Standpoint

BY JULIAN LOEBENSTEIN

In connection with the appraisal of an Edison tube distribution system of a large Eastern lighting company, considerable investigation was required to determine the proper values to be used. In what follows, the methods employed in arriving at the original cost of this system are outlined. At the time the appraisal was made most of the system was more than twenty years old, so that a great many of the records examined were also that old. The listing of the material was made from the company's maps, which showed the various routes of feeders and mains with the services tapped therefrom. As a rule, the sizes were also given, but where this was not the case the assumptions made were based on a knowledge of the prevailing practice at the time of the installation. The quantity of tube material found, including the coupling and junction boxes, was summed up, a considerable task in itself.

A careful inquiry as to the records of price disclosed the fact that the company still had in its possession a catalog showing the original prices. Here, then, was a basis for starting work. It was known that discounts had been allowed on the prices as shown in the catalog, and to determine these it was necessary to examine the vouchers of tube purchases covering the years during which the material was bought. These discounts were listed and plotted as shown in Fig. 1. At the same time that these vouchers were examined other records showed up valuable information as to labor, prices and the amount of labor, hauling, and the magnitude of other charges incidental to the handling and laying of the tube. One instance of valuable information obtained was the disclosure of the storage center in use at that time. This, of course, aided in making correct allowances for haulage and freight charges. These discounts, as shown by the vouchers, were also checked by an examination of the purchasing department's files.

The curve of discounts shows that in different years the discount varied from 20 per cent to 60 per cent, so that it was essential to establish as nearly as possible the amounts purchased in each year. This was done by plotting the capital expenditures for the underground distribution system, as shown by the capital accounts of the company. This curve is also indicated in Fig. 1, and shows a sudden rise in 1897 and again in 1900, but from what was known of the history of the company it was believed that this was due to the building of duct lines. A cursory examination of the vouchers for those years showed $175,000 out of $250,000 to be for duct lines. This was without considering consumers' services at all or items less than $1,000. There is no doubt that such a consideration would have reduced the remaining $75,000 to $50,000 or less. With this knowledge of low expenditures for tube after the year 1896, the curve from that year on was assumed.

As further proof that the discount curve was a representative one, the following data were secured:

Capital expenditure for tube, by examination of accounts	$1,475,000
Of this, labor was considered as 20 per cent	295,000
Cost of material	$1,180,000
Tube cost, from vouchers examined	750,000

This shows that prices and discounts had been secured on 64 per cent of all the tube purchased, and that the discount curve was therefore a close approximation to what the company had actually been allowed by the manufacturer. As a further check and as a matter of interest, especially to show the value of following up all leads for information, another curve is given in Fig. 2, which shows the number of feet installed as given by the directors' reports and by the vouchers. These figures not only substantiate each other, but also serve as a check on the number of feet of tube as listed from the map records.

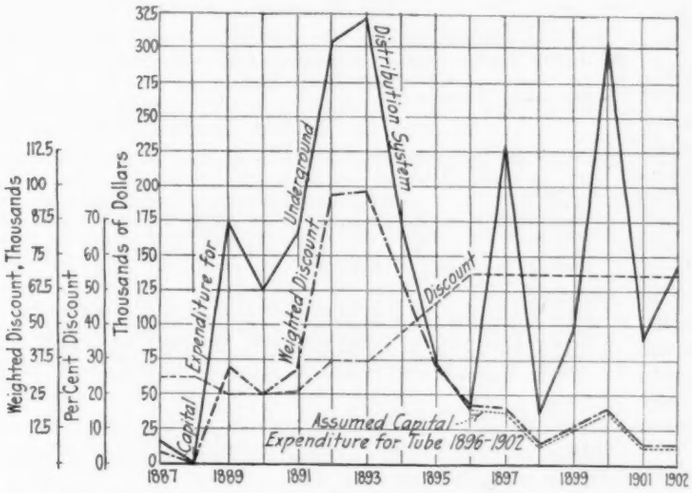


FIG. 1—CAPITAL EXPENDITURE AND DISCOUNT FOR EDISON TUBE

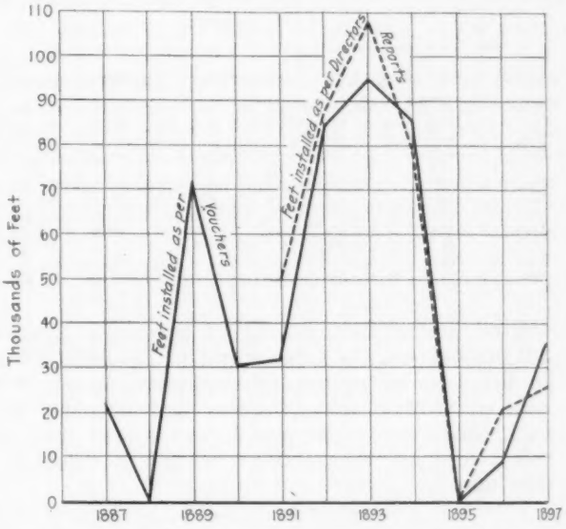


FIG. 2—YEARLY INSTALLATIONS OF EDISON TUBE

The foregoing procedure and results show the value of keeping all construction records and correlating data which is often considered unimportant after a certain period. It brings out the importance of an engineer's familiarity with accounting and recording systems, and the necessity for him to be able to translate these records into terms which will be useful in placing prices on the items of a physical inventory. It is found that in many cases the same items will be classified under various headings, so that in tracing old or obsolete apparatus or material much time may be saved by finding out just what names were given to various articles.

In the particular instance referred to, the records had been kept in a remarkably good condition. Few, if any, of the links in the chain were missing. Had this not been the case it would have been an almost impossible task to assign an original cost, and since the material is no longer manufactured there would have been no present-day basis for comparison.

July Electric Earnings $31,300,000

Percentages of Increase During Midsummer Month Over Corresponding Month of Last Year Are 14.7 Per Cent in Earnings and 20.6 Per Cent in Output

STATISTICS gathered and compiled by the ELECTRICAL WORLD relating to central station operation during the month of July last show the earnings to have increased over July of last year by 14.7 per cent and the output to have increased by 20.6 per cent. Based on these figures, which were received from 61 per cent of the central station industry, the total income of the electric light and power companies of the United States during July of this year amounted to $31,300,000 and the total output to 1,814,000,000 kw.-hr. In this case gross earnings represent income from the sale of electric energy alone, and output represents only that energy for which an income was actually received. All transactions within a company were eliminated.

For the first seven months of the current year the income of the entire industry totaled $234,400,000, against $203,300,000 during the first seven months of 1915. This is an increase in income of 15.3 per cent. The output for the first seven months of 1916 was 12,664,000,000 kw.-hr., compared with 10,364,000,000 kw-hr. during the first seven months of 1915. The increase was 22.2 per cent.

Estimates based on the above figures for the first

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percentage of Industry Represented	Income from the Sale of Energy			Kw.-Hr. Output		
		1915	1914	Per Cent Increase	1915	1914	Per Cent Increase
August..	64	17,342,796	16,024,893	8.2	951,752,053	853,381,696	11.3
Sept.....	65	18,547,170	17,074,927	8.6	1,003,606,094	871,573,412	15.1
Oct.....	65	20,112,813	18,329,490	9.8	1,087,786,658	949,288,459	14.7
Nov.....	65	21,899,048	19,720,232	11.6	1,150,669,073	948,704,941	21.3
Dec.....	64	23,418,774	20,962,264	11.8	1,230,655,404	1,004,108,399	22.5
		1916	1915		1916	1915	
Jan.....	65	25,286,336	22,352,721	13.2	1,200,672,452	984,205,683	22.0
Feb.....	65	22,133,485	19,175,537	15.3	1,121,452,738	869,537,132	29.1
March...	65	22,027,627	18,722,742	17.8	1,212,363,217	969,888,339	25.2
April....	64	21,206,946	18,375,014	15.5	1,137,602,995	920,464,917	23.1
May.....	64	20,254,914	17,477,443	15.9	1,165,148,209	940,171,859	24.0
June....	64	20,156,238	17,462,410	15.9	1,165,626,536	964,158,214	20.8
July.....	61	19,075,389	16,664,924	14.7	1,106,685,575	917,963,497	20.6

TABLE III—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED BY SIZE

	Oct.	Nov.	Dec.	Jan.	Feb.	Mch.	April	May	June	July
INCOME:										
Group 1.....	8.7	9.8	10.2	10.7	14.1	16.0	13.9	14.4	14.9	14.0
Group 2.....	11.4	12.8	13.8	21.3	20.0	18.5	17.0	17.9	18.1	17.2
Group 3.....	23.4	18.0	19.8	18.3	20.7	28.1	24.7	26.2	21.8	19.0
Group 4.....	8.7	11.9	13.6	13.1	15.7	17.3	17.4		11.0	9.2
Group 5.....	5.7	13.0	13.0	7.2	18.5	26.5	16.1	15.8	14.8	14.5
								24.0		
OUTPUT:										
Group 1.....	10.7	17.0	19.0	19.0	25.4	22.0	20.0	21.3	18.7	18.7
Group 2.....	21.4	29.0	31.5	28.0	40.6	28.1	25.5	18.4	17.7	23.5
Group 3.....	27.3	36.0	33.0	33.2	39.6	39.0	37.7	40.0	33.3	27.6
Group 4.....	13.4	18.0	16.3	22.6	29.7	18.2	22.7	23.0	19.5	16.3
Group 5.....	1.7	13.4	9.7	8.5	22.4	29.9	32.0	33.2	18.8	16.5

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	Oct.	Nov.	Dec.	Jan.	Feb.	Mch.	April	May	June	July
INCOME:										
Group 1.....	12.7	13.8	14.8	16.5	18.0	21.5	16.0	17.0	16.4	12.6
Group 2.....	12.6	12.7	16.1	15.4	19.9	19.0	21.2	19.5	19.8	20.6
Group 3.....	17.3	15.5	22.8	22.1	29.7	38.7	15.5	24.0	18.2	12.8
Group 4.....	8.8	9.0	9.6	11.3	15.1	18.1	13.2	13.5	7.2	4.8
Group 5.....	8.3	13.7	23.5	20.6	26.3	54.5	27.6	27.0	21.7	25.4
OUTPUT:										
Group 1.....	20.8	28.7	26.2	29.0	38.5	30.9	25.0	28.2	30.0	19.2
Group 2.....	15.3	30.0	26.5	26.0	36.8	27.8	31.4	33.2	26.3	14.1
Group 3.....	8.7	23.0	22.5	39.5	41.6	49.0	38.1	43.0	15.0	23.8
Group 4.....	20.6	20.1	18.5	15.0	23.0	17.4	36.1	30.0	21.0	27.4
Group 5.....	1.8	51.0	14.5	22.6	25.6	58.7	71.8	54.4	31.7	36.0

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States (Illinois Excluded)			Percentage of Industry Represented	Pacific and Mountain States		
			1915	1914	Per Cent Increase		1915	1914	Per Cent Increase		1915	1914	Per Cent Increase		1915	1914	Per Cent Increase
INCOME	August....	63	2,057,635	1,855,140	11.0	68	6,853,118	6,511,307	5.3	56	4,749,082	4,231,322	12.2	88	3,545,454	3,288,729	7.8
	September.	66	2,162,064	1,949,663	11.0	68	7,288,842	6,904,245	5.5	57	5,285,358	4,691,751	12.6	88	3,664,215	3,387,717	8.2
	October...	66	2,327,214	2,073,059	12.3	68	8,096,982	7,550,808	7.2	57	5,820,653	5,153,314	13.0	88	3,798,012	3,477,051	9.3
	November.	66	2,472,539	2,188,049	13.0	67	8,894,805	8,158,589	9.0	57	6,342,582	5,554,226	14.2	88	4,069,995	3,703,124	10.0
	December.	66	2,817,557	2,448,813	15.0	67	9,335,396	8,529,866	9.4	57	6,983,909	6,063,349	15.1	88	4,150,045	3,773,810	10.0
			1916	1915			1916	1915			1916	1915			1916	1915	
	January...	66	2,819,144	2,432,177	15.0	67	9,589,347	8,564,488	12.0	57	7,834,831	6,717,799	16.6	88	4,182,114	3,823,156	9.4
	February..	66	2,599,760	2,185,967	18.8	67	8,978,797	7,854,345	14.3	57	6,660,062	5,568,337	19.7	88	3,761,364	3,443,182	9.3
	March....	66	2,595,777	2,122,177	22.0	67	8,998,962	7,660,667	17.5	57	6,470,612	5,394,250	20.1	88	3,787,925	3,386,286	11.9
	April....	64	2,221,544	1,898,749	17.0	67	8,794,056	7,596,567	15.8	56	6,289,092	5,292,974	19.0	88	3,825,701	3,520,381	8.8
	May.....	65	2,103,585	1,788,219	17.0	67	8,226,231	7,131,063	15.4	56	5,994,792	5,040,789	19.0	88	3,874,270	3,469,871	11.6
	June.....	65	2,208,994	1,906,233	16.0	67	8,045,839	6,905,114	16.5	56	5,919,038	5,061,833	17.2	88	3,907,418	3,531,597	10.7
	July.....	60	2,061,717	1,820,585	13.5	63	7,537,568	6,448,245	16.8	56	5,818,903	4,989,830	16.5	81	3,543,181	3,30,0365	7.2
KW.-HR. OUTPUT	August....	63	71,954,506	60,870,433	18.5	68	329,947,721	302,960,234	8.9	56	272,508,518	240,423,753	13.4	88	276,631,551	248,463,980	11.3
	September.	66	74,835,203	63,716,224	17.3	68	358,765,971	319,549,780	12.3	57	286,893,057	247,046,941	16.1	88	279,133,989	237,795,633	17.5
	October...	66	82,568,951	69,882,867	18.3	68	400,516,741	353,685,472	13.3	57	305,962,017	268,972,416	13.7	88	292,885,613	251,095,356	16.8
	November.	66	87,193,883	69,359,620	25.8	67	420,584,253	355,151,259	18.5	57	333,528,905	269,870,536	23.7	88	301,772,412	248,913,893	21.0
	December.	66	99,744,195	80,446,521	24.1	67	447,158,465	373,213,316	20.0	57	363,859,444	293,266,707	24.1	88	311,034,100	249,996,678	24.5
			1916	1915			1916	1915			1916	1915			1916	1915	
	January...	66	97,072,794	77,029,974	26.2	67	431,201,554	356,809,437	20.8	57	362,121,067	284,407,361	27.5	88	301,645,060	258,982,414	16.5
	February..	66	92,855,679	68,982,535	34.8	67	411,715,612	320,924,478	28.1	57	339,326,360	252,816,291	34.1	88	268,653,564	220,662,826	22.1
	March....	66	97,321,924	74,958,898	29.9	67	439,660,902	349,347,454	26.0	57	360,872,072	282,179,673	28.0	88	304,327,753	255,450,143	19.3
	April....	64	84,709,660	64,816,830	30 8	67	403,223,021	326,574,302	23.4	56	344,866,175	273,367,413	26.4	88	302,386,347	253,778,348	19.2
	May.....	65	84,719,642	64,318,892	31.8	67	409,529,049	33,585,886	22.0	56	340,864,700	271,838,358	25.5	88	328,793,900	266,599,708	23.2
	June.....	65	87,829,797	69,506,884	27.6	67	396,630,887	327,541,507	21.2	56	345,126,144	284,533,932	22.0	88	328,832,919	277,797,366	18.5
	July.....	60	78,927,991	65,752,474	20.1	63	374,578,173	310,811,449	20.5	56	344,896,685	282,085,327	22.7	81	298,762,257	252,234,250	14.5

seven months of the year place the income for 1916 at considerably more than $400,000,000, or well over $50,000,000 in excess of the earnings for 1915. The estimated output for 1916 is 22,000,000,000 kw.-hr., an increase of, roughly, 4,000,000,000 kw.-hr.

July totals kept up with those for previous months in the year, but the percentage increase in income was smaller. This was owing to the July, 1915, figures, which showed the results of the early industrial reawakening during the year. One thing is very noticeable in the returns, and that is the stability of output during the first seven months of 1916. Income was not stable except during the months of May, June and July. This was to be expected, owing to the natural falling off in the lighting load. The total output, however, was greatest in April, amounting then to 1,865,000,000 kw.-hr., and lowest in February (a short month), when it was 1,725,000,000 kw.-hr. The July output was but 30,000,000 kw.-hr. less than that for January, or less than the monthly output of any of the really large companies. These figures show the stabilizing effect of a large power load, especially such a load as is being carried this year. Factories are working night and day, and with a steady consumption more than fill up the gaps left by the seasonable receding of the lighting load.

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED BY SIZE

	Oct.	Nov.	Dec.	Jan.	Feb.	Mch.	April	May	June	July
INCOME:										
Group 1.....	6.2	7.6	8.3	11.1	13.7	16.7	15.1	14.5	16.4	17.7
Group 2.....	11.9	15.0	14.0	18.2	18.4	21.2	18.5	21.7	21.9	18.5
Group 3.....	11.0	10.0	13.1	11.9	14.6	20.5	15.3	17.7	12.0	14.2
Group 4.....	9.8	14.4	15.3	17.4	19.4	17.9	19.5	14.0	15.4	10.0
Group 5.....	10.9	14.6	12.2	16.0	15.8	12.2	15.6	13.0	15.2	13.4
OUTPUT:										
Group 1.....	12.1	16.0	20.1	21.1	30.8	29.2	26.1	25.5	13.1	24.1
Group 2.....	16.8	26.6	25.5	26.4	33.4	25.6	35.6	11.3	31.8	27.4
Group 3.....	15.8	22.1	16.6	20.1	22.0	16.0	13.7	18.0	13.2	11.5
Group 4	14.8	22.0	18.9	15.6	21.8	20.9	19.0	12.6	19.7	17.0
Group 5.....	2.8*	18.6	20.6	1.5	24.0	13.1	8.9	35.0	11.1	12.6

*Decrease

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED BY SIZE

	Oct.	Nov.	Dec.	Jan.	Feb.	Mch.	April	May	June	July
INCOME:										
Group 1.....	12.3	17.0	15.8	14.3	18.3	19.3	18.2	18.0	16.4	15.8
Group 2.....	10.2	10.8	9.8	25.5	20.5	19.1	18.0	18.0	18.2	17.8
Group 3.....	22.7	24.0	25.1	24.3	27.0	23 0	26.7	27.2	20.5	18.6
Group 4.....	16.0	19.8	18.3	9.6	20.2	22.9	22 8	23.5	17.3	21.0
Group 5.....	24.7	9.6	18.0	5.7	11.1	14.4	9.4	21.3	12.6	6.1
OUTPUT:										
Group 1.....	10.4	22.0	21.9	24.9	30.3	25.2	24.7	25.0	23.8	21.0
Group 2.....	14.0	21.5	31.0	28.8	44.0	32.3	23.9	22.5	12.3	26.9
Group 3.....	34.2	43 0	41.2	32.5	44.0	40.6	43.5	41.0	31.8	26.0
Group 4.....	33.5	36.7	18.5	53.4	41.0	31.9	39.2	37.8	34.7	22.0
Group 5.....	3.0	17.3	20.6	13.3	15.9	19.1	10.1	14.7	4.0	8.6

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	Oct.	Nov.	Dec.	Jan.	Feb.	Mch.	April	May	June	July
INCOME:										
Group 1.....	7.5	7.5	6.0	11.6	6.7	8.5	3.9	7.2	7.5	4.2
Group 2.....	14.3	15.7	17.3	†	†	18.7	3.5*	2.3	1.2	0.6*
Group 3.....	21.4	20.0	24.6	19.7	22.0	28.1	40.0	39.0	39.5	28.3
Group 4.....	0.1	4.3	10.8	3.0	8.2	17.5	11.7	13.8	3.6	1.0
Group 5.....	3.1	13.5	3.9	10.5	17.8	26.3	12.0	19.1	11.2	13.2
OUTPUT:										
Group 1.....	7.1	9.9	13.1	9.1	13 0	22.7	8.0	12.0	8.0	10.2
Group 2.....	41.3	51.0	56.0	†	†	28.3	3.6*	2.2	1.0	2.0
Group 3.....	52.4	67.0	67.0	56.0	68.8	39.0	80.0	79.0	74.5	56.1
Group 4.....	1.5	6.2	10.5	1.8	13.8	18.6	10.3	21.8	10.0	4.0
Group 5.....	3.5	8.3	1.0	1.0	20.1	30.0	11.7	17.5	14.6	11.0

*Decrease. †Results omitted owing to insufficient returns.

INDUSTRIAL ACTIVITY

July was a replica of previous months so far as industrial activity was concerned. Business conditions generally showed no falling off, nor did industrial activity. Incoming orders, however, were not so heavy, but this was occasioned by deliveries, and it is generally felt that as soon as this swamped condition lightens a bit orders will come in more rapidly. Indications, therefore, are for continued increasing activity on the part of the light and power companies which with the winter load coming on, should report record results.

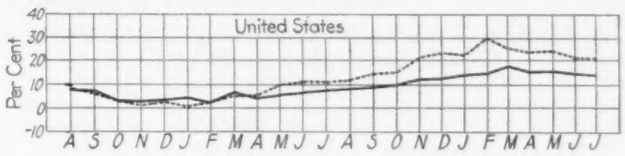
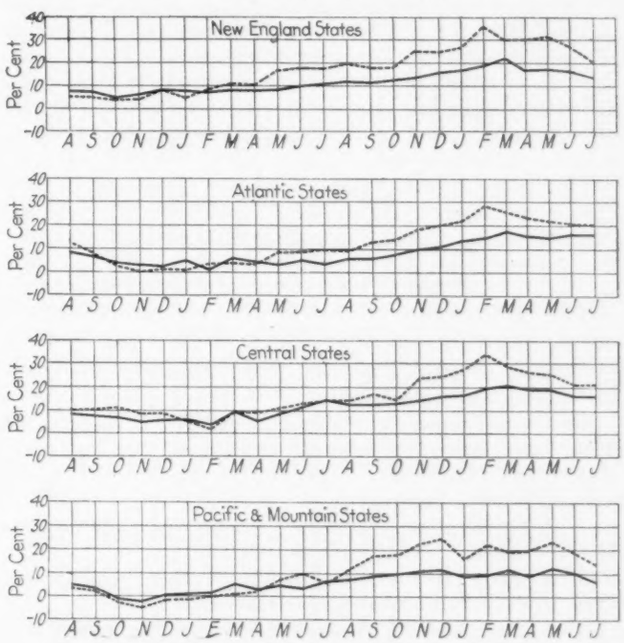


FIG. 1—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES

The extent to which central stations have been pushed to supply service is well illustrated by the demand for turbines. It has been estimated that 2,000,000-kw. rated capacity for steam turbines will represent the 1916 central station demand. When it is remembered that the total rated capacity of the central stations of the United States is but 7,000,000 kw., which includes water, steam, oil and gas, the significance of the above turbine figures will be appreciated.



FIGS. 2 TO 5—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

EXPLANATION OF TABLES

The accompanying curves show graphically the percentages of increase to be found in Tables I and II. The remaining tables give the percentages of increase by companies grouped geographically according to size. Group 1 contains those companies situated in cities of more than 100,000 population, group 2 in cities of between 50,000 and 100,000 population, group 3 between 25,000 and 50,000, group 4 between 10,000 and 25,000, and group 5 between 5000 and 10,000.

STATION AND OPERATING PRACTICE

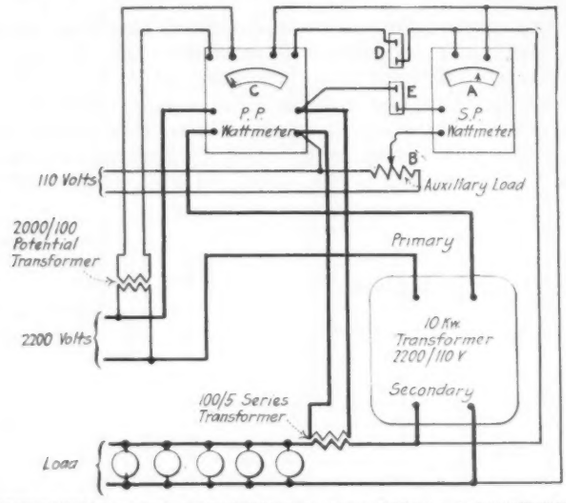
A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

DETERMINATION OF TRANSFORMER LOSSES

A Method Suitable for Efficiency Tests Whereby Losses Alone May Be Read on an Independent Wattmeter

BY PERRY A. BORDEN

When determining the efficiency of a transformer by the method of direct loading, it is usual to read the input and output on separate wattmeters, the ratio of these slightly differing quantities being the efficiency of the apparatus. The actual losses are thus represented by a very small portion of the scale, and the



INSTRUMENTS AND CONNECTIONS FOR DIRECT MEASUREMENT OF TRANSFORMER LOSSES

difference of two quantities both subject to the errors of the instruments used.

In what follows, a method is described wherein the total losses taken collectively are directly read on an independent wattmeter. The apparatus for making the measurements includes:

1. A single-phase wattmeter of suitable scale to measure the losses (say 100 volts, 0.5 amp.).

2. A variable load, preferably of the potentiometer type to give full scale on this meter.

3. A polyphase wattmeter or watt-hour meter free from interference troubles, carefully adjusted to "buck on zero," *i.e.*, to have zero torque when the two elements are measuring quantities of equal and opposite magnitude. The circuits of the polyphase meter will be (usually) 100 volts, 5 amp.

The accompanying diagram shows the arrangement for measuring total losses in a 10-kw. 2200/110-volt transformer. The instrument transformers are so chosen that the constants of the two elements of the polyphase meter are equal. In this case the primary voltage is measured with a 2000/100 potential transformer, while the secondary current passes through a 100/5 series transformer, the constant of each phase of the meter being 20. The polyphase instrument is connected in such a way that while the input gives a positive deflection, the output tends to oppose it.

The single-phase meter is then placed in circuit as shown, receiving its potential from the same source as the output element of the polyphase meter, and its current from any source approximately in phase with the potential. If the source of supply for the auxiliary current be not electrically connected to the main supply, the auxiliary meter *A* may, if desired, be connected to the input element of the wattmeter *B*. The adjustable current of meter *A* passes with the load current through the polyphase instrument in such a direction as to give a small additional negative torque. It is, of course, understood that sufficient grounding or interconnection will be made to prevent dangerous voltage between parts of the polyphase wattmeter.

The method of operation is as follows: With switches *D* and *E* open, the transformer is loaded until the desired input is read on the scale of meter *A*. Switch *D* is then closed and the indication falls to the small value representing the difference between input and output (*i.e.*, losses). Switch *E* is then closed and the auxiliary current is carefully adjusted until meter *B* indicates exactly zero. The reading of the auxiliary meter multiplied by the metering constant, represents then the total losses in the transformer under test, and the efficiency may be accurately determined by the usual formula.

This method is particularly suitable to the testing of large numbers of similar transformers, and will be found suited not only to transformers, but to any class of electric apparatus in which both the incoming and outgoing energy are carried on two-wire circuits.

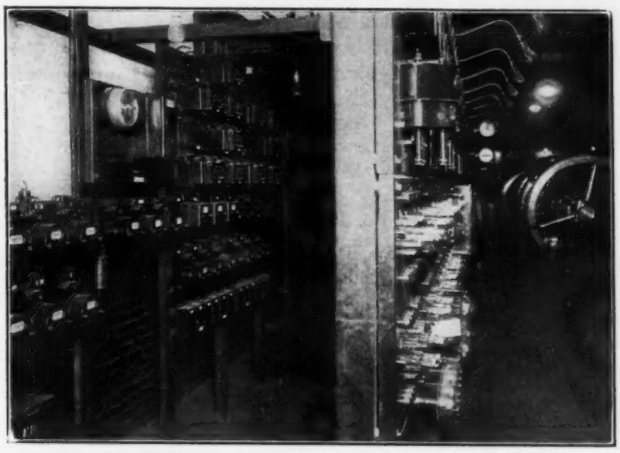
How a Middle West Company Uses Watt-Hour Meters on Feeders

The Public Service Company of Northern Illinois has adopted the practice of placing an ordinary customer's type of watt-hour meter on each feeder circuit at the point where it leaves the company's station. This practice is followed almost without exception in the larger communities served by the company; however, at some of the smaller transformer stations one meter in each phase of the low-tension distributing system is sometimes made to suffice. Readings on all of these meters where a station attendant is employed are taken hourly, so that the company secures a record of kilowatt-hours per hour on each phase of each feeder circuit.

These data are used by the company's statistical department for two purposes. They are of particular value in determining diversity factors, when it is desired to learn whether or not a generating station could be constructed in a certain district, or whether that district could be served from another plant by means of a transmission line. This company, as well as others controlled by the same interests, believes that true diversity is not shown by the station load, and in fact is not even shown by the feeder loads. The diversity factors obtained on data taken from individual feeders are much more nearly accurate than those obtained from station load conditions. The diversity factors obtained through feeder load data have been found fairly accurate.

Another use to which this data is put is that of check-

ing feeder losses. The work connected with the preparation of the feeder loss report from this data is much greater, however, than might be supposed, due to the fact that the records of customers' meters which must be used in connection with the records of these station meters cannot be taken simultaneously, since all customers' meters on a single feeder are seldom read on the same day. The station watt-hour meter data can be and are being used for this purpose, however, whenever special feeder loss reports are required. The data are also used in making studies of class rates.



WATT-HOUR METERS ON FEEDER CIRCUITS OF OAK PARK STATION OF PUBLIC SERVICE COMPANY OF NORTHERN ILLINOIS

While these watt-hour meters have been installed on nearly all of the company's feeders, the numbers of ammeters and other usual switchboard instruments have not been reduced. Readings are taken on these indicating instruments just as though no use were being made of the watt-hour meters.

How Analysis of Load Conditions Permitted Reduction of Maximum Demand

By replacing obsolete and inefficient apparatus with modern electrical equipment and by analyzing the load to determine which apparatus could be kept off the peak each day, the engineer in a large Chicago retail store has been able to improve the plant economy and reduce the maximum demand enough so that energy expenses for the entire store which had meanwhile been enlarged about 50 per cent, were not much larger than before. One of the first steps toward securing these results was taken when provision of additional power had to be considered for the store extension. Up to this time, energy had been generated in a private plant, but owing to the inadequacy of the equipment to new needs and the expenses of installing new equipment it was decided to use central station service. The boilers of the old private plant were retained, however, for heating purposes. With the source of energy decided on, efforts were next directed toward replacing obsolete and inefficient energy apparatus.

TABLE I—NEW EQUIPMENT AND THAT SUPERSEDED IN OVERHAULED SYSTEM

Equipment Displaced	Equipment Installed
125 series arc lamps 2 steam passenger elevators 2 steam freight-elevators 1 11-in. by 14-in. engine driven 10-ton ice machine 1 15-in. by 14-in. engine driving three generators 1 8.5-in. by 10-in. engine driving one generator	74 kw. in incandescent lamps operated on 3 wire d.-c. circuits 224 hp. in motors, including one 40-hp. and one 20-hp. motors driving ice machines, three 34-hp. motors on three elevators, and two 15-hp. motors on two elevators, one 7.5-hp. motor on ventilating system, one 7.5-hp. motor on sprinkler pump, one 5-hp. motor on house pump and seventeen other small motors

Meanwhile, the store had been enlarged so that the space to be heated and lighted, supplied with water, etc., increased in the ratio of 103,250 to 166,130, which figures are the floor areas of the original store and the present store respectively in square feet, the ceiling heights being the same. Despite this addition, however, the reduction in operating costs, including heat, light, power and everything pertaining thereto, was enough to largely offset the cost of maintaining the increased size of the store.

TABLE II—OPERATING EXPENSES THAT EXISTED WITH OLD AND NEW EQUIPMENT

Old Plant Expenses (Heat, Light, Power, Etc., for Floor Area of 103,250 Square Feet)		New Plant Expenses (Heat, Light, Power, Etc., for Floor Area of 166,130 Square Feet)	
1908	$9,562	1913	$13,398
1909	9,767	1914	13,765*
1910	10,103	1915	13,657
1911	10,100		

*Larger ice machines installed accounts for increase over 1913.

After the operation of the new equipment was well under way, the engineer sought to effect further economies. Realizing that the maximum demand charge assessed by the central station company was actually interest on the generating equipment held in reserve to serve the store equipment and that maintaining better load factors would reduce maximum demand and consequently the net energy rate, the engineer inserted an ammeter in each leg of the service leads so that he may keep a close check on his load. Now, when the peak-load period approaches, apparatus which can be disconnected without seriously hindering store operations is de-energized. The refrigerators are kept at such a temperature that one machine can be cut out for an hour or more at any time and both machines shut down simultaneously, if necessary, to prevent registering a high maximum demand. For the same reason, arrangements were made so that one of the freight elevators can be shut down during the peak load and also before the window lamps, representing a 65-amp. load, are turned on. In analyzing load conditions to reduce the peak, it was found that electric-range demonstrations could be discontinued during the peak-load hours, thus eliminating 15 amp. more. Aside from the peak-load reduction caused by careful operation, substitution of tungsten lamps for less efficient units caused the greatest saving in the electric-service bill, the engineer declares. This is obvious when it is considered that the lighting load forms a considerable part of the total, the store being open two nights a week. In one instance, when a new manager took charge of the furniture department and wanted the lamps lighted all the time, the general manager granted his request, but the engineer exchanged

TABLE III—COST OF ENERGY AND MAXIMUM DEMANDS FOR SAME PERIOD OF THREE YEARS

Year and Month	Cost of Energy	Maximum Demand (Kw.)	Year and Month	Cost of Energy	Maximum Demand (Kw.)	Year and Month	Cost of Energy	Maximum Demand (Kw.)
1913 November	$588.17	113	1914 November	$616.57	113	1915 November	$548.96	100
December	647.74	120	December	647.19	117	December	575.97	107
1914 January	690.68	120	1915 January	632.81	113	1916 January	585.73	100
February	580.63	113*	February	563.10	107	February	536.60	100
March	568.98	113	March	523.09	83	March	521.10	97
April	578.52	113	April	560.34	107	April	487.96	90
May	569.98	113	May	570.39	103			

*One freight elevator cut out during peak-load period.

the 60-watt lamps for 40-watt units and thus prevented an increase in the monthly energy bill.

The result of this diligence on the part of the engineer and his close watch of the load to avoid a higher demand is best shown in Table III.

Besides receiving a generous salary the engineer is paid a bonus at the end of each year on the savings he has made.

Convenient Method for Filing Apparatus Costs and Station Records

H. C. Carroll, chief engineer of the plant of the Muncie (Ind.) Electric Light Company, keeps two unusual record books which he maintains save time for him and save money for the company. One of these is a loose-leaf record of power plant purchases filed according to names of firms and dates. The other is a loose-leaf

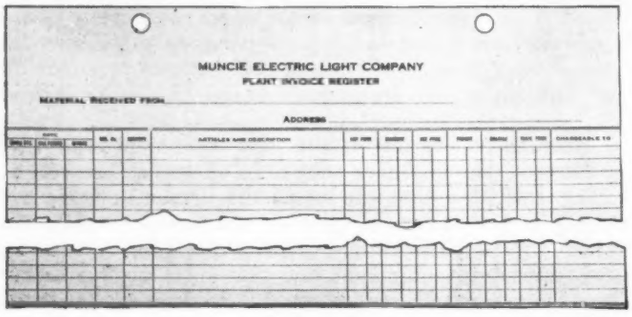
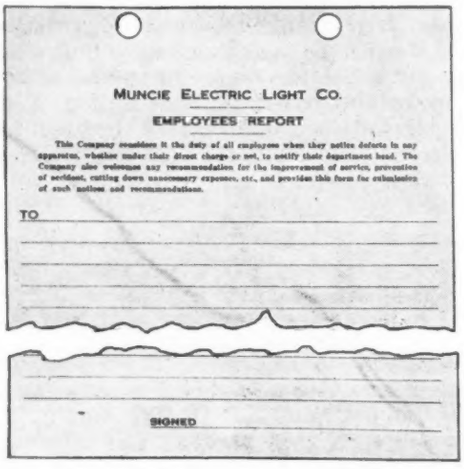

MUNCIE ELECTRIC LIGHT COMPANY
PLANT INVOICE REGISTER

FIG. 1—RECORD FORM FOR FILE OF POWER PLANT PURCHASES

The three left-hand columns of this form are devoted to dates goods are received, bills passed and invoices issued. Following these in order are columns for the number of articles required, quantity, description of articles, list price, discount, net price, freight, drayage, total price and account chargeable.

record of reports on power plant repairs. From the former book the engineer can easily ascertain information on prices and discounts formerly quoted together with names and addresses of firms with which business has been done. The record sheets for this book are made out in the engineer's office when bills for material purchased are sent to him for approval. Especially


MUNCIE ELECTRIC LIGHT CO.

EMPLOYEES REPORT

TO

SIGNED

FIG. 2—RECORD FORM FOR FILE OF PLANT REPAIRS

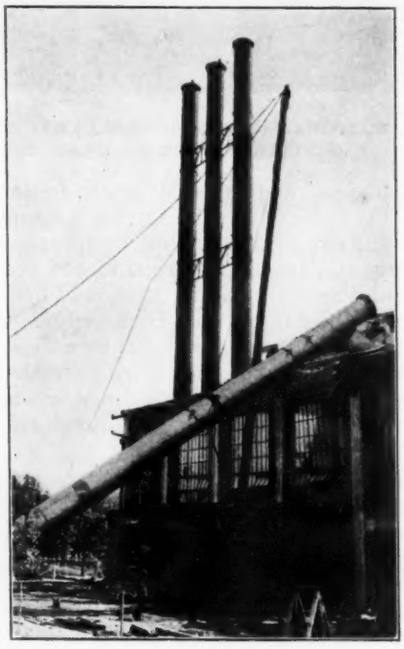
where the plant engineer does much of his own purchasing such a book is very valuable as a price and discount record.

In the file of reports on plant repairs the sheets are arranged so that all repairs for a particular unit are together. The reports originate with the operating men, who are instructed to "write out a slip" for every needed repair, no matter how small it is. These slips are given to repair men, who also use them for reporting repairs completed. With this sort of a record the engineer can scan the performance of any plant unit easily at any time. The system is said to be better for the engineer than a repair cost account since it tells just what was done on each job.

The cost of maintaining these records at the Muncie plant is said to be little except the cost of the forms. The results in time saving and reduced maintenance charges easily justify this cost.

Rapid Restoration of Service

Nine hours and fifteen minutes after the Citizens Electric Company's station at Hot Springs, Ark., was damaged by a tornado this summer, the plant was placed in operating condition and service furnished to the entire city. The storm swept the four tall steel stacks, which serve the plant, off their bases, thereby stripping safety valves, steam lines, etc., off the tops of the boilers. In addition the main transmission line to the city had been wrecked. To rehabilitate conditions as quickly as possible, twenty-five men were engaged to install temporary steam lines and to repair the transmission circuits. Since the stacks were buckled in falling to the ground they were cut off at the bent portion and the shortened sections hoisted by a gin pole into position over the boilers. More permanent repairs were made later. M. E. De France is chief engineer and S. E. Dillon is manager of the company.



LAST OF FOUR STACKS WRECKED BY TORNADO BEING HOISTED TO PLACE

Trench Digger Used in Laying Boiler Feed Pipe Line

Two mechanical trench diggers were employed by the Consolidated Gas, Electric Light & Power Company, Baltimore, Md., recently in laying 16,874 ft. of cast-iron pipe for supplying salt-free water to its boilers. The new supply line extends about 3 miles upstream where chemical tests have shown the water to be free of salt. This pipe line had to be built because continued drought reduced the flow in the Papapscow River, on which the company's Westport station is located, so much that brackish harbor water under the influence of high tide and wind contaminated the old boiler feed intake.

The trenching machines mentioned are of the Austin type and are similar to ordinary tractors, but are equipped on the rear end with excavating apparatus, which is driven by an internal-combustion engine. The

excavating mechanism consists of scoops attached to endless chains or link work. It discharges the excavated material onto a horizontal cross belt which conveys the refuse to the bank at one side of the trench. The excavators were used through considerable lengths of the route but could not be employed in stony soil or

MACHINE USED BY BALTIMORE COMPANY TO LAY PIPE LINE

where the earth was full of tree roots. The trenching machines were borrowed from the gas department where they are ordinarily used to lay gas mains in suburban districts. Sixty-one working days were required to excavate 14,655 ft. of the trench by machine, the remaining 2219 ft. being dug by hand. The average number of men engaged per day was eighty.

Isolating and Locating Arcing Grounds

While lightning may break down only a transformer or regulator, the disturbance set up by an accidental arcing ground tends to weaken all of the insulation on lines and apparatus metallically connected to the defective circuit. Therefore, when an arcing ground occurs every effort should be made to locate the trouble and clear the system from it in the shortest possible time. Methods of doing this have been studied by the Consumers' Power Company, Jackson, Mich. One method which has been adopted has been to require that all storm and disturbances of any kind be reported to the load dispatcher at once. While the storms are invariably promptly reported, the transmission line disturbances, unless they affect the service, are not always so promptly called to the attention of the system operator. In conjunction with these operating rules, the electrical equipment has been arranged so as to prevent the spreading of disturbances. For instance, at Battle Creek, Kalamazoo, Grand Rapids and Muskegon banks of transformers are provided for each high-tension line, the banks being connected in parallel on the low-tension sides, but are isolated on the high-tension sides so that there is no metallic connection between the high-tension lines. At Owosso, transformers between the 140,000-volt and 40,000-volt lines serve the same purpose, that of sectionalizing the system or isolating the sections as far as high-frequency disturbances are concerned. In general, it has been found that high-frequency surges due to grounds do not pass through the transformers to such an extent that lightning arresters discharge on the side away from the trouble. With this arrangement, it is simple to locate trouble in any section by opening sectionalizing switches in the section and observing which lightning arresters discharge continuously.

In addition to observing the action of the high-tension lightning arresters, one of the best means that the Consumers' Power Company has of detecting grounds on the high-tension system is the action of the private telephone system. Another indication of trouble is the pressure of static electricity around high-tension apparatus. A fairly reliable test to ascertain the phase that is grounded is to touch each of the phases with the end of the high-tension switch hook. A static spark will jump from the phases that are not grounded to the switch hook, while the phase that is grounded will appear to be dead; that is, very little if any spark will be noticed. The hum and heating of motors and the dimming of lamps can all be used to determine when a three-phase system is grounded.

Too much dependence cannot be put on telephones as a means of locating high-tension grounds. Sometimes, for example, the telephone line parallel to a certain section of a transmission system may be noisier than usual, and be more heavily charged than lines in other directions and paralleling another part of the system, and still it will not be an indication that trouble is located on the former line. It is very often the case that more trouble is experienced on the telephones farthest away from the trouble. Arcing between contacts of a high-tension switch may cause an effect on telephone circuits that may be mistaken for a grounding. This is sometimes due to the switch mechanism being out of adjustment and not closing properly. The Consumers' Power Company has found that surges are generally more severe at the ends of the line, and that lightning arresters near the trouble may not discharge as heavy as those farther from them. This observation is taken into account when trying to locate grounds.

Exhausting Gas from Manholes

In underground cable work manholes are encountered in which the gas is so bad that it is practically impossible for men to work in them. If the work to be done is of an urgent nature and time cannot be taken to wait for the gas company to repair the leak causing the trouble, special means of ventilating the manhole is essential. The Commonwealth Edison Company of Chicago has made successful use of standard Lancaster geared-type blowers for this purpose. A 10-ft. length of 3-in. hose is connected to the blower and inserted in the manhole and one of the helpers delegated to turn the crank. The blower forces a considerable quantity of air into the bottom of the manhole, which displaces the gas and supplies fresh air to the workmen. In particularly bad instances a continuous operation of the blower has enabled work without danger of asphyxiation.

HAND BLOWER IN USE FOR VENTILATING MANHOLE

COMMERCIAL AND BUSINESS POLICY

A Department of Plans and Methods for Widening the Application of Electricity and for Extending Electric Service

MAKING USE OF A MODEL OFFICE INSTALLATION

Electrical Equipment of New Central Station Office Building at Pueblo, Col., Utilized for Demonstrating to Architects and Contractors

As suggestions to the prospective builder and as reminders to architects and contractors, the Arkansas Valley Railway, Light & Power Company has equipped its new office building at Pueblo, Col., with model installations of various kinds of office and building apparatus.

To this end, explains W. F. Raber, vice-president and general manager, the new structure has been fitted up with a fireproof transformer compartment, latest type junction boxes, properly arranged meter loops, electrically driven condensation pumps for the heating system, electrical heaters for hot water supply in the building, electric addressographs, adding machines, etc. This varied equipment is, of course, scattered throughout the building, but is useful for demonstrating to architects and contractors, in a practical way, the latest and best devices to be installed along these lines.

The accompanying illustration shows the attractive outside lighting of the new structure, with its 1400 10-watt lamps and flood-lighted flag. The method of taking this photograph will be of interest to many electrical men who have attempted to have pictures taken of flood-lighted flags.

A night when a stiff wind held the flag nearly in one plane was at first thought to be the best time for taking such pictures. Recently, however, E. F. Stone, superintendent of light and power for the Arkansas Valley company, has discovered the more satisfactory method of attaching a small steel wire such as is commonly used in armature banding, to one corner of the flag and to some other object, at an equal height with the flag, such as a building across the street. On a very calm night this wire will hold the flag in a vertical plane so that it can be successfully photographed. The picture shows "Old Glory" flood-lighted by three 500-watt General Electric projectors hidden from view by the fire wall on top of the building.

A FLOOD-LIGHTED AMERICAN FLAG AND SOME 1400 10-WATT LAMPS WHICH OUTLINE THE BUILDING, MAKE THE NEW OFFICE OF THE PUEBLO, COL., COMPANY AN ATTRACTIVE SPOT BY NIGHT

THE SELECTION OF ELECTRIC-RADIATOR SIZES

Why Large Units Are More Economical Than Small Ones, for the Temporary Heating of Rooms

BY R. S. HALE

Superintendent Special Research Bureau,
Edison Electric Illuminating Company of Boston

The principles and policies by which electric light is sold to a customer so that it may stay sold, are by no means the same as those which should be used in the sale of electric heat.

For instance, one of the Boston Edison Company's salesmen went out to interview an electric-radiator prospect, and said he was going to try to have installed the largest electric radiator the prospect could afford to *use*. The salesman was, of course, a lighting salesman, who had been trying to sell as large lighting installations as the prospect could afford to use, but no larger. The good lighting salesman is careful not to overlamp the customer, because he knows that too many lamps make too large a bill for electricity and so cause dissatisfaction. It is very easy for a lighting salesman to fall into this error because the first cost of 100-watt lamps is practically the same as that of 50-watt lamps; but if the salesman gets too big lamps put in at the start, this causes trouble later.

In the case of heat, however, the situation is different, in fact, almost the opposite. If the salesman above referred to had said he was going to sell the biggest radiator the prospect could afford to *buy*, he would have been all right, and as he was a good salesman we will trust this was what he meant, though he said "use," and not "buy."

In the case of lighting, too big an installation will make the bills too big and cause dissatisfaction.

In the case of an electric radiator it is the reverse. The larger the radiator (within limits, of course) the smaller the bill, and the customer better satisfied, while a small radiator will make the bills higher.

The reason for this apparent paradox is that (with a few exceptions) electric radiators are used only when the heat is wanted for a convenience and for a short time. A big radiator will give the required temperature much more quickly than will a small radiator, and not take any more kilowatt-hours. This follows because in the case where the heat is needed as a temporary convenience, there will be some one present to shut off the electric heat in whole or in part the moment the required temperature is reached, and so a large radiator will give the required temperature at a less expenditure of kilowatt hours.

Further, with a small radiator the customer is

tempted to leave it on, so as not to have to wait when he wants to use the room.

Both these causes result in bigger bills.

In the case of electric cooking the same principle holds true. We should always sell the customer the largest range he can afford to buy because (with exceptions, of course) the large range will cook more quickly and use less kilowatt-hours than the small range, thereby giving much greater satisfaction to the customer.

PEAKS NOT SERIOUS

The central station need not be afraid of these short high peaks. They may sometimes require a little more transformer capacity, especially if there is only one range on a transformer, but the moment two or three or more ranges are considered, the diversity factor will smooth out the curve. Even if it did not, the extra cost to the station of additional kilowatts, after it has made its first investment and built the lines, is very small, much smaller than most of us think; but this is not the place to enter into this discussion.

The point is, that when we sell electric heat we want the customer to take the largest heaters and the largest ranges so as to have the highest temperature we can give him in the shortest time.

This policy means satisfied customers, because this will give them smaller use in kilowatt-hours and smaller bills.

There are, of course, exceptions, and one is worth mentioning: any heater which is intended to be left permanently in circuit, *i.e.*, for several hours at a time without attention, should, of course, be no larger than is absolutely necessary. For instance, the little heater designed to be left under the hood of an automobile to keep the water from freezing should be only large enough to do the work.

If, however, the same customer wants a radiator in his garage so that he can warm the room, he should have just as large a one as possible up to the limit of what he will pay in first cost. Similarly, for ordinary cooking or ordinary electric heating, make an installation that will do the work well and quickly. Don't send a boy to do a man's work, but sell man-size radiators and man-size heaters.

An Electric-Range Campaign Aboard Ship

Aboard the Pacific Mail steamship Equador, which sails from San Francisco and which will touch various points in Japan, China and the Philippine Islands, is a domestic-science demonstrator who is serving electrically cooked biscuits with the regular 11 o'clock broth and little tea cakes with the 5 o'clock tea customary on Pacific Ocean steamers. At some ports at which the vessel stops—among which are Hongkong and Honolulu—daily demonstrations over a period of two weeks have been prearranged. Local representatives of the American electrical firm which is responsible for this unusual campaign, will co-operate to secure an attendant at these demonstrations.

This unusual method of advertising was made possible through the efforts of Mr. Rossiter, who is president of the Sperry Flour Company, which wished to advertise its flour, and the vice-president of the Pacific Mail Steamship Company. Through the San Francisco branch of the Western Electric Company the Hughes electric range used was loaned to the flour company for the trip. The latter concern paid the expenses of the demonstrator, and also the expense of securing a competent electrical contractor to install the range on the vessel.

Advertising to the Public the New Improvements for Their Benefit

Let's Understand Each Other Better

1st. The owners of the Brinkley Water & Light Co., have put their money in Brinkley because they believe in its future.
2nd. Their interests are identical with those of every other loyal progressive citizen, for Brinkley's growth and prosperity is ours
3rd There is no one thing so essential to the advancement of Brinkley's interest as that of having satisfactory water and lights, and it is our one aim to give to the public the finest possible service in that line.
4th. We are spending thousands of dollars right now in the sinking of a deep well in order to get ready for this. To be plain we are going to spare no energy or money to give to Brinkley just the best possible service.
We want the general public to be open and free to suggest to us at any and all times just how we can improve and give to the Brinkley public a more satisfactory service.
Tell us about it and we will appreciate it. Watch this space each week for we'll have a message for you.

Brinkley Water & Light Co.

AN ADVERTISEMENT THAT APPEARED IN THE BRINKLEY (ARK.) WEEKLY "ARGUS" FOLLOWING THE TRANSFER OF THE LOCAL ELECTRIC UTILITY PROPERTY TO NEW OWNERSHIP

The central station property at Brinkley, Ark., a town of 3000 inhabitants, recently changed hands, having been purchased by the Commonwealth Utilities Company of St. Louis, Mo. The new manager, J. E. Strasbaugh, has begun a series of friendly talks to the local public through the town's weekly newspaper, telling of the new owners' plans for giving better service than ever before, to the people of Brinkley.

The effect of even the first advertisement, was immediately noticeable. People dropped into the office for a chat with the new officials, and a number purchased electrical appliances to try out in their homes.

The first "ad" of the series is reproduced herewith. The second told of the efforts to secure better water supply for the town by sinking a new well.

"This is only one of the many improvements we are preparing in order to give the people of Brinkley the very best possible service," reads the advertisement. "Our idea is that there is nothing too good for our patrons. We are going to please you if there is any reasonable way on earth to do it. Kindly bear this in mind, and if you think of anything that we can do to improve our service, tell us, please."

Performance Data on Electric Truck in Coal Hauling Work

On observing the performance of an electric truck and two gasoline trucks hauling from a loading platform to the State House on Beacon Hill in Boston, Mass., the following data were obtained: The round trip from the loading platform to the delivery point is 3.7 miles. One 5-ton gas car, one 4.5-ton gas car and one 6-ton electric were employed on this job. The conditions of loading and unloading were practically the same as were the hours per day. The 5-ton gas car delivered 49 tons in twelve trips; the 4.5-ton gas car delivered 40 tons in thirteen trips, and the electric delivered 86 tons in thirteen trips. The actual running time for the electric was 8 hours and 58 minutes. The truck was operated from 7.12 a. m. until 4.40 p. m. with

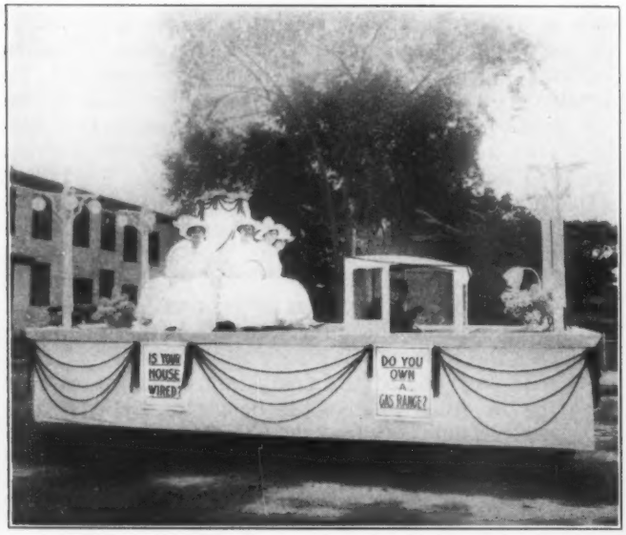
one-half hour out for dinner. The battery was changed once during the period.

From the data given it will be seen that both gas trucks were underloaded while the electric truck was regularly overloaded. An officer of the coal company, however, estimates that his per diem cost on a gas truck is from 60 to 70 per cent greater than it is on an electric.

It is interesting to note that the two gas trucks hauled practically the same amount of coal during the day as was hauled by the one electric. That this was not a freak performance of the electric is evidenced by the fact that the next day the same car carried twelve loads aggregating 78 tons and the following day twelve loads aggregating 76 tons, making a total of 240 tons of coal in three nine-hour days. This same electric, a few days later, on shorter hauls, delivered 123.5 tons of coal in nineteen loads, leaving for the first load at 7.12 a. m. and finishing at the garage at 5.05 p. m. with about three-fourths of an hour stop at noon. The loading time was six minutes per load. The actual distance covered was 26.5 miles.

Biddeford (Me.) Company Shares in Celebration of Town's Tercentenary

From Sept. 14 to 16 the city of Biddeford, Me., held its tercentenary celebration to mark the 300th anniversary of the first landing of white settlers at the mouth of the Saco River in 1616, from which settlement resulted the town of Biddeford of 1916.



BIDDEFORD CENTRAL-STATION FLOAT IN PARADE MARKING 300TH ANNIVERSARY OF FOUNDING OF TOWN OF BIDDEFORD, MAINE

Among the features of the celebration was a competitive window-trimming contest which was productive of a material improvement in general store-window lighting as well as an increased interest in store windows as advertising mediums.

The illustration shows the York County Power Company's line department truck decorated for the parade. The ornamental street-lighting posts were featured in this display, as the city of Biddeford is now considering the installation of an ornamental lighting system for a "white way" on its main street.

F. R. Fowles is general superintendent of the York County Power Company. Albert Cartier, city salesman for the company, designed the float illustrated.

Wiring and Illumination

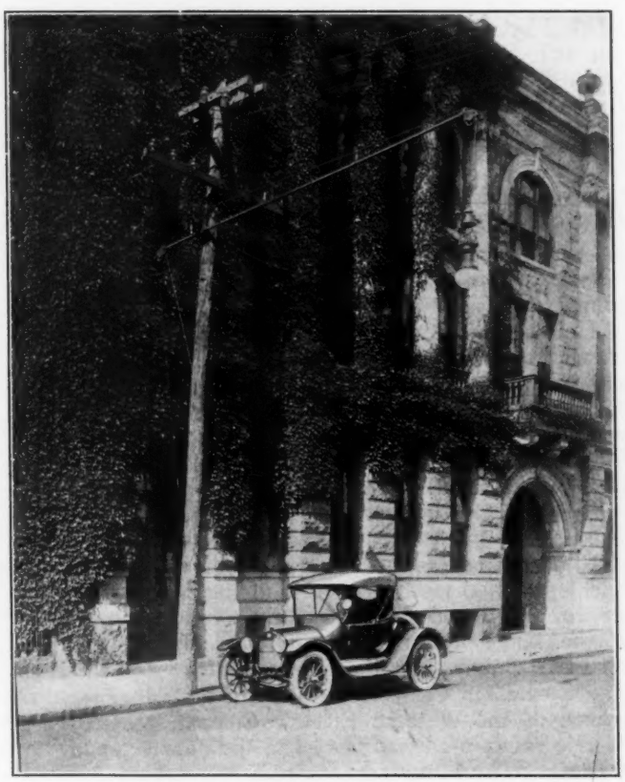
Latest Practice in the Electrical Contracting Field and in the Art of Interior and Exterior Illumination

GAS-FILLED UNITS FAVORED AT TAUNTON, MASS.

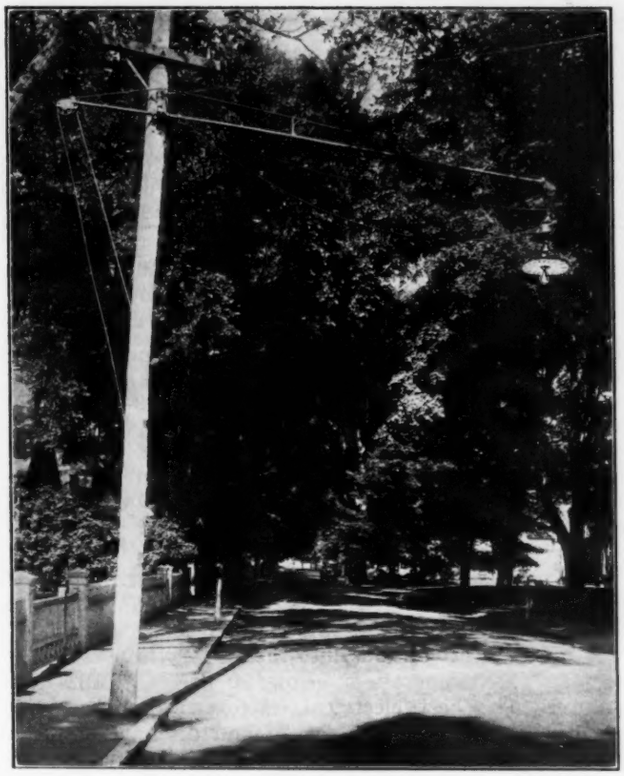
Better Light Distribution and Long Life Features of New Installation of 1750 Type C Series Units Which Have Been Substituted for Inclosed Arcs

Unusual satisfaction has been experienced with the use of gas-filled lamps at Taunton, Mass., where 1750 Mazda C units rated at 60-cp. to 1000-cp. have been substituted for 275 475-watt series inclosed arc lamps. Aside from permitting the generating plant to furnish more light with less energy consumption, the new system has been attractive because of the extraordinary average life of the lamps. Some of the gas-filled units have lasted almost 8000 hours, while on the average they have given 4500 hours' service. In view of the short period of development which gas-filled lamps have passed through, L. D. Wood, manager of the plant, considers this a remarkable performance. It can be partly attributed, however, to the lack of "shorts," surges and "pumping" in the circuits due probably to the all-incandescent series circuits, the extensive tree trimming and ample ground clearances.

In practically all cases 6.6-amp. 250-cp. lamps were employed. On one side street, however, twelve 600-cp. units were used, and in the center of the business district 20-amp. 1000-cp. Mazda C lamps were substituted for magnetite arc lamps. The 1000-cp. lamps were fitted



GAS-FILLED STREET LAMP IN BUSINESS SECTION OF TAUNTON, MASS.—THIS PICTURE SHOWS ONE OF THE 1000-CP. NOVALUX UNITS



GAS-FILLED UNITS ON LONG MAST-ARMS AVOID HEAVY FOLIAGE OF CITY'S RESIDENTIAL STREETS—IN THE OUTLYING DISTRICTS 250-CP. LAMPS ARE USED

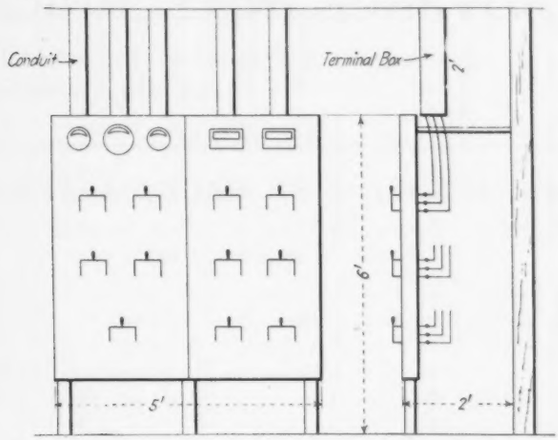
with Novalux fixtures and opal globes without refractors. In all cases it was possible to use the old mast arms, hangers and cutouts, so that it was only necessary, in making the change, to obtain hoods with eyebolts, sockets and reflectors for the 250-cp. units and substitute the Novalux fixtures direct for the magnetite arc lamps.

COST OF CHANGING OVER

The cost of changing over the units was $4 per lamp for the 250-cp. and 600-cp. units and about $12 per lamp for the 1000-cp. units. The shades were left off the 1000-cp. lamps to permit the light to illuminate the building fronts and produce the so-called "White-Way" effect.

The maintenance expense has been decreased by dispensing with trimmers' services and employing a night patrolman to replace all broken or burned-out lamps. The change in the lighting system has been attended with smoother and more even distribution of light in all cases, according to Mr. Wood, who is highly pleased with the results.

Saving the Wireman's Time in Connecting Conduit Lines to Switchboard



SWITCHBOARD WIRED FROM TERMINAL BOX

At the left of the sketch above is shown the elevation of a switchboard with conduit leading from the ceiling to the switchboard. The engineer for a large New York contracting firm who has equipped a great many buildings with switchboards declares that by installing a terminal box as shown much time is saved in wiring to the switchboard, and furthermore, that a much neater and better-looking job results.

The conduit pipes end in the top of the terminal box at the ceiling line and the wires from the conduit are led down through bushings in the bottom of the terminal box to the wires leading from the switch connections on the back of the board, and therefore pass in a straight line to the switches and are not "jumbled" up as when led direct from conduit pipes.

Meridian Company's Windows Utilized to Raise Standard of Window Lighting

In order to show local merchants how attractively merchandising lines can be displayed with the aid of electrical effects, the Meridian (Miss.) Light & Railways Company, has for some weeks been using its show windows for this purpose. "Daylight" lamps are used for lighting the company's own windows and various uses of electrical appliances are shown. Besides exhibiting these appliances these displays demonstrate to the public and to the merchants the effects that can be obtained by the use of "daylight" lamps.

A background of white enamelled trellis work has been used as shown, and with this different floral effects have been employed.

"DAYLIGHT" LAMPS ARE USED TO LIGHT THESE ATTRACTIVE WINDOWS OF THE MERIDIAN (MISS.) LIGHTING COMPANY

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

THE ALKALINE STORAGE BATTERY

Effect of Temperature Upon the Performance of the Edison Storage Battery

THE effect of variations of temperature upon the performance of the Edison nickel-iron storage battery is the subject of a paper presented last week at the New York meeting of the American Electrochemical Society by L. C. Turnock of the department of chemical engineering of the Carnegie Institute of Technology in Pittsburgh. Since the storage battery generally finds service in climates where there is a comparatively great difference between the temperatures of the winter and summer seasons, its performance and variation of capacity with changes of temperature in such localities, or under analogous thermal conditions, is of importance commercially. Conditions of service the battery is commonly called upon to meet are, first, a charge at one temperature with a subsequent discharge at a lower temperature; secondly, a charge at one temperature followed by a discharge at a higher temperature, and, thirdly, both charge and discharge at either high or low temperatures.

It is common observation among users of storage batteries that the available capacity decreases with lowering of temperature. In vehicle service this is manifested by the fact that it is found impossible either to obtain the mileage per charge or to maintain the delivery schedules that experience had shown possible at higher temperatures. It is considered good practice not to discharge a battery, while it is delivering a certain recommended current, below a specified terminal voltage per cell. This so-called cut-off voltage is a purely arbitrary value, to which the capacity of the battery is measured. It is entirely permissible to carry the discharge further and without injury to the battery, but the selection of the value is prompted by the fact that the battery will give its best service and show its best practical efficiency if the discharge is not carried beyond this limit.

Batteries discharged at low temperatures (during cold seasons) appear to have less capacity because the voltage limit of discharge is reached sooner than if the battery were discharged at higher temperatures. The temperature coefficient of resistance of the electrolyte being negative, the lower temperatures cause a higher internal resistance, which in turn results in a higher internal (IR) "drop" and consequent lower terminal voltage. Moreover, since the electrical energy of the battery is a result of certain chemical reactions and the speed of chemical reactions, in turn, is a direct function of temperature, it follows that the amount of available active material would be considerably less, and perhaps an earlier realization of the cut-off voltage should be anticipated.

The author's rather extensive tests were made with an auxiliary test electrode consisting of a portion of one of the nickel hydrate tubes which compose the positive plates of the battery. In order to complete a cycle of charge and discharge within a convenient length of time a current rate of 15 amp. was employed; this is about twice that recommended as a "normal" rate, but the author thinks that the results obtained therewith under variable temperature conditions should be entirely comparable to those obtained at a lower rate.

Two cells were tested. Tests were carried out at temperatures varying between 20 and 90 deg. C. (68 and 194 deg. Fahr.), and the results are given in the original paper in a series of tables and diagrams. The chief results are summed up as follows:

The available current efficiency of the battery at charge and discharge rates twice the value of the recommended "normal" rates increases up to 50 deg. C. (122 deg. Fahr.), after which it begins to fall off rapidly with further increase in temperature.

The current efficiency on discharge is higher than on charge, as evidenced by practically no gas evolution during discharge even at rates higher than "normal."

A more effective input into the battery is possible by keeping the temperature below 50 deg. C. (122 deg. Fahr.). The best electrical efficiency is obtained by charging at a low temperature and discharging at a higher temperature.

The operation of the battery at temperatures above 50 deg. C. (122 deg. Fahr) is detrimental to the life of the battery. The capacity of the positive or nickel hydrate electrode may be restored by an overcharge at a low temperature. The capacity of the iron or negative electrode will continue to lose in capacity with operation at high temperatures and its lost capacity cannot be restored with overcharging.

The presence of hydrogen peroxide in the electrolyte during the various states of charge of the battery may account for the low capacities experienced with the battery allowed to operate at high temperatures. On charge it functions as a reducing agent toward the positive electrode and has the effect of an oxidizing agent toward the negative electrode.

Another view explaining the low capacity of the positive and negative electrodes, and which the evidence so far obtained seems to support the more strongly, is as follows:

On charge the nickel peroxide (NiO_2) and nickelic oxide (Ni_2O_3) form a solid solution, in which the concentration of NiO_2 in the equilibrium phase decreases with increase in temperature.

The highly active metallic iron of the charged negative plates is soluble in the electrolyte, and the rate of solution increases with increase in temperature. Solution of the iron in the electrolyte results in a permanent loss of capacity.

It is dangerous to allow the battery to become overheated and stand even on open circuit in a place that is not sufficiently ventilated, artifically or otherwise. Evolution of hydrogen and oxygen, in the proper proportion to form in themselves a highly explosive mixture, is evident at 50 deg. C. (122 deg. Fahr.), and the rate increases rapidly with increase of temperature.

Generators, Motors and Transformers

Connections of Armature Coils to Commutator Segments.—RUDOLF KNOLL.—To determine the positions of the poles and brushes for a commutator machine, the armature coil must have its ends connected to given segments on the commutator. The author refers to the trouble often experienced in practice when finding the

requisite segments. The workman often makes a mistake about this, which is only detected when the finished machine is tested. Sometimes it is asserted that the whole thing is a matter of indifference, but this is only true if one is at liberty to place the brushes in any position. With a given design of machine, however, the position of the pole and the setting of the brushes are definitely fixed from the first. In this case the connection of the armature coils to the commutator must be made on certain definite principles which have relation to the question of commutation. This is particularly the case with alternating-current machines, which are very sensitive to the correctness of the setting of the brushes. The author gives a simple formula by which the required segment on the commutator can be found.

$$L_m = \frac{a+b+l}{2} = \frac{y_k+b}{2} + 1$$

This formula holds good for wave, lap and spiral windings, on the assumption that with the completed machine the middle of the brush position coincides with the middle of the main pole. L_m is that segment which is on the line AB in Fig. 1, on the assumption that AB

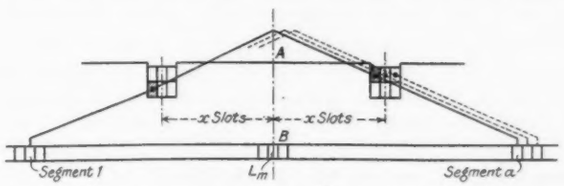


FIG. 1—CONNECTIONS OF ARMATURE COILS TO COMMUTATOR

is equidistant from the two slots; $a = y_k + l$ where y_k is the spacing reckoned in commutator segments; b is the number of conductors required to fill out the slot shown on the right in Fig. 1 (in this case $b = 2$). Several numerical examples are given to illustrate the formula.—From *Elek. Zeit.*, No. 14, 1916, translated in London *Electrician*, Sept. 8, 1916.

Induction Motor Theory.—F. T. CHAPMAN.—A continuation of a mathematical paper on the air-gap field of the polyphase induction motor. In the present instalment the author discusses the reaction of the rotor circuits on the stator field and develops the circle diagram. He also discusses the "crawling" of induction motors. The crawling tendency may be reduced by skewing the rotor slots. Such skewing has the further advantage of lessening the liability to humming when the motor is loaded. In the case of an existing motor of normal construction the tendency to crawl may be reduced by cutting through the end rings of the squirrel cage. This is the method generally adopted. It has the advantage of being easily carried out, and will be found to eliminate the trouble in most cases.—London *Electrician*, Sept. 1, 1916.

Lamps and Lighting

Rating of Incandescent Lamps.—R. NAUJOKZ.—An illustrated translation of his recent article in *Electrotechnische Zeitschrift* on the rating of incandescent lamps according to watts. The author shows that the system is not altogether in the interest of the consumer, and is also liable to cause considerable trouble to the contractor. "The new system of rating lamps provides no method of distinguishing between them. It is not possible to say how the average consumer is to choose the lamp which is best suited to his requirements. All lamps look very much alike, and it is not very easy at a glance to distinguish between them. And if, as is very likely, lamps of higher efficiency should be introduced, the confusion will become greater still. The rating according to watts leads to wrong values being placed on the lighting capacity of a lamp, and just as a man has every right to know the output of a machine which he is proposing to buy, so he ought also to be provided with information as to the light which may be expected from a given lamp."—London *Electrician*, Aug. 25, 1916.

Generation, Transmission and Distribution

Prevention of Condenser Corrosion.—J. F. PETER.—An illustrated abstract of a paper read before the (British) Institute of Marine Engineers on the Cumberland electrolytic method of preventing corrosion in condensers, boilers, etc. The apparatus used consists of a low-tension dynamo, generating a 6 to 10-volt direct-current, and pieces of iron suspended in the water contained in the vessel to be protected and suitably insulated from it. These iron electrodes are connected to the positive pole of the generator, while the body of the condenser is connected to the negative pole, so that it is the cathode of a strong artificial cell. "The Cumberland process has overcome most obstinate cases of corrosion, and it was also discovered that it has a remarkable effect in decomposing and removing hard scale in boilers. . . . It has been adopted on a large scale by shipping companies; the Union Steamship Company of New Zealand has all its boilers equipped, and a number of the White Star vessels have it fitted to their boilers and condensers; it has also received the approval of the inventions and research committee, and is being fitted to ships of the British Navy. The amount of current found necessary to insure protection from corrosion varies somewhat. In the case of surface condensers, 1 amp. for 500 sq. ft. cooling surface is found in practice to afford complete protection. Take the case of a surface condenser containing 6000 sq. ft. of cooling surface; the amount required will be 12 amp. at 8 volts, equal to 96 watts at 1 cent per kilowatt-hour. This would cost, roughly, $8.75 per year running continuously. The number of anodes fitted to a condenser of these dimensions would be six, each weighing 20 lb. As these would require renewing each year, the amount of iron consumed would be less than 120 lb., at the outside cost of $3.75 to cover casting and drilling. Therefore, the total annual expense would work out at $12.50 for a condenser of these dimensions. Where only the question of corrosion has to be dealt with in boilers, it is found that considerably less current is required than 1 amp. per 300 sq. ft."—London *Elec. Review*, Aug. 25, 1916.

Installations, Systems and Appliances

The Influence of Pressure on the Electric Ignition of Methane.—W. M. THORNTON.—A paper presented at the Newcastle meeting of the British Association for the Advancement of Science. The influence of small changes of gas pressure upon electrical ignition is important in coal mining. Apart from the effect of pressure on the presence of gas or the dryness of the mine, a change from a low barometer of 28 in. to a normal 30 in. somewhat increases inflammability by impulsive sparks, but has little effect on that by condenser or circuit-break sparks. The compression of an explosive mixture increases its inflammability by condenser sparks, and lowers it when the sparks are impulsive. Circuit-break sparks have the same igniting power over a long range of pressure. In every case there are mixtures in which ignition is abnormal, giving rise to steps or sudden changes in the form of the curves of observations.—London *Electrician*, Sept. 8, 1916.

Electrophysics and Magnetism

Effect of a Magnetic Field on the Initial Recombination of the Ions Produced by X-Rays in Air.—G. E. M. JAUNCEY.—The author describes results of testing the

direct effect of a magnetic field on the ionization current in air at atmospheric pressure when the applied voltage is either above or below the saturation voltage. In the experiment with voltage above saturation homogeneous secondary X-rays from copper were used. In this experiment the effect of a magnetic field on the total ionization produced by X-rays was examined. The results show that the magnetic field, and consequently the bending of the secondary cathode rays into curvilinear paths, does not alter the total ionization produced in a gas by X-rays. In the experiment with voltage below saturation the effect of a magnetic field on the relation between the voltage and the ionization current was examined. The results show that the total ionization is unaltered by a magnetic field if the strength of the ionizing agent remains constant, and since the ionization current of 310 and 324 are nearly the saturation current, the readings with the field were all reduced in the ratio of 324 to 310. It is concluded that (1) a magnetic field of the intensity here used has no effect on the total ionization produced by X-rays. (2) A magnetic field of the intensity here used has no effect on the initial recombination of the ions produced by X-rays.—*American Journal of Science,* August, 1916.

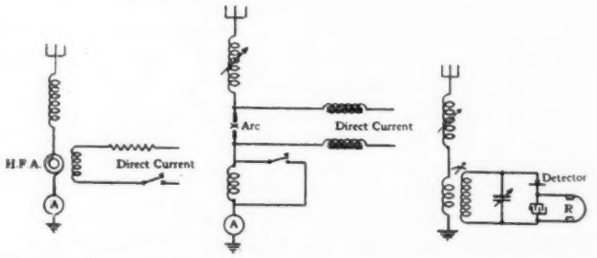
Magnetic Shielding.—At a recent meeting of the Royal Society, a paper on "The Magnetic Shielding of Large Spaces and Its Experimental Measurement" was read by Prof. E. Wilson and Prof. J. W. Nicholson. It appears that (*a*) the magnetic shielding of a large space is a problem wholly different in practice from that of a small space, and in view of important applications the efficiency to which such shielding can be raised is a matter of importance. Considerations of mobility of the apparatus and weight of iron required necessitate the solution of the problem of maximum shielding for a given weight of iron and more than two shells together with an examination of the limitations of utility of lamination. These problems are discussed in the paper. (*b*) A field of order as low as 3×10^{-3} has been obtained in a space of radius 30 cm. by the use of 1273 kilos of high permeability dynamo magnetic steel, and an accurate method designed for the measurement of fields of lower order. (*c*) The leakage through air spaces in a magnetic shield has been studied. (*d*) It is now possible to examine the behavior of iron under practically no magnetic force.—London *Electrician,* July 28, 1916.

Relations of the Photo-Potentials Assumed by Different Metals When Stimulated by Light of a Given Frequency.—A. E. HENNINGS and W. H. KADESCH.—An account of an experimental investigation, the chief results of which are as follows: The photo-current-potential curves plunge sharply into the potential axis. This indicates that photo-electrons released from a given surface under the influence of light of a given frequency have energies which do not exceed a definite value. The apparent maximum positive potentials assumed by six of the common metals under the influence of light of a given frequency were the same. A falling off in the maximum energy of emission of electrons was observed with increasing age of surface. This was most marked in the case of magnesium, but took place to a smaller degree with all the other metals. This shift can be explained on the assumption of the gradual formation of retarding films. In a second paper by the same authors the relation of their work to Einstein's theory is discussed. Their experimental results appear to confirm Einstein's equation.—*Phys. Review,* September, 1916.

Influence of Occluded Gases on the Photo-Electric Effect.—R. J. PIERSOL.—An account of an experimental investigation, the chief results of which are as follows: A photo-electric effect exists which is due entirely to an intrinsic property of the metal. Superposed on this effect there is a maximum effect due to occluded gases. The maximum effect is dependent upon the activity of the gaseous surface film (its magnitude being a function of the amount of gas driven to the surface). The abnormal effects are due to the emission rather than the absorption of occluded gases. In metals of high fusion point, a sufficient number of heatings drive off the occluded gases to such an extent that all abnormal effects disappear. The photo-electric sensitiveness, after the emission of occluded gases, is larger than the effect noted before the expulsion of the gas.—*Phys. Review,* September, 1916.

Telegraphy, Telephony and Signals

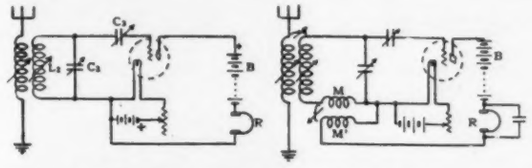
Recent Improvements in Radio Communication.—A. F. VAN DYCK.—This article reviews in a general way the problems of radio engineering. The fundamental requirements of a radio system are outlined and the different methods of generating high-frequency current for the antenna which distinguish the different systems of radio transmission. The method, used by Marconi in his first work in which he obtained the high-frequency current from the oscillatory discharge of condensers is referred to as one that bids fair to hold its own for some time to come, particularly in ship installations, because of its greater simplicity and ease of operation as contrasted with later systems. The operation of the condenser discharge method, in improved form called impulse excitation, is explained and objections to it reviewed, reference being especially made to the spark gap. The operation of two improved designs of spark gap which meet requirements—the synchronous rotary gap and the quenched gap—one of which is always used in modern spark sets, was explained. The chief advantage of the spark method of generation is claimed to be due to the fact that it can be easily in-



FIGS. 2, 3, 4—HIGH-FREQUENCY ALTERNATOR WITH FIELD CONTROL FOR SENDING, ARC GENERATOR WITH DETUNING CONTROL, AND INDUCTIVELY COUPLED RECEIVER

stalled on ship or shore, is rugged and requires little expert attention when once adjusted. This type of generation gives what is usually called damped wave or grouped wave transmission. If, instead of these grouped waves, with a certain number of wave trains (condenser discharges) per second, we could have a continuous forced current, better tuning effects could be secured, as well as some other advantages mentioned later. This is accomplished by each of the three other methods of generation now possible, which give what is called sustained wave transmission, in distinction to the grouped wave transmission. These methods mentioned and described are direct generation by a high-frequency alternator, Fig. 2; the next method is that of arc generation, and high-frequency current generation, Fig. 3. It is reported that the second type of generation has been chosen by the United States Navy for the high-powered stations in the United States and foreign possessions. The new method of high-frequency current generation is very promising, and is an unexpected development of a device which has been

in use for a number of years, the audion. It was by means of this method that the recent long-distance radio-telephone transmission was accomplished. The audion circuits as invented by Dr. DeForest, and as used for several years, are shown in Figs. 5 and 6. A brief explanation of the audion action is given. The new developments in receiving reported by the author



FIGS. 5 AND 6—USE OF AUDION AS A VALVE AND AS AN AMPLIFIER

make use of the fact that the wing current is of radio frequency equal to the frequency of the incoming signal, and in phase with it, since there is no appreciable lag in the operation of the ionic device. Continuous wave transmission, he claims, has many advantages. The ordinary spark receiving set, such as shown in Figs. 4 and 5, will not permit reception of continuous waves, since this receiver integrates each group of waves, each spark, into one vibration in the telephone. The ticker system of receiving described permits the continuous wave to be heard by making it discontinuous at the receiving station instead of at the sending station. The heterodyne system, invented by Fessenden, which combines with the current of the received signal a locally generated current of slightly different frequency, giving a resultant current having beats, was described and its disadvantages outlined. The heterodyne method has, however, become commercially feasible with the discovery that the audion could be made to generate. The magnetic amplifier recently described by F. W. Alexander (Proceedings Institute of Radio Engineers, April, 1916), and referred to in the ELECTRICAL WORLD for July 29, page 234, was mentioned. This device is used for controlling radio-frequency current from an alternator, which is applicable to radio-telephony, and which has worked successfully on outputs of 75 kw.—*Electric Journal*, July, 1916.

Efficiency vs. Economy in Electric Heating of Domestic Water Supply

To the Editor of ELECTRICAL WORLD:

Sir:—Robbed of all its technicalities, the problem of domestic water heating is a fascinating subject. Considered from a strictly scientific standpoint the heating effect of the heat units in kilowatts of electricity refuse to produce any more heat than the heat units in cubic feet of gas.

Confusion is caused by paying too close attention to the scientific side of the problem and neglecting the practical application of electric devices used for heating water for ordinary household purposes.

The article by R. L. Webb in the June 24 issue of the ELECTRICAL WORLD, page 1464, has attracted my attention because it is a very interesting presentation of certain facts about the subject. It would perhaps be of interest to have further facts brought out bearing more directly upon the use of devices rather than upon comparisons with other methods such as gas water heating.

The article referred to assumes that meter rates as applied to electric range service would not be practical for water heating, and explains that several companies adopt flat rates in order to get the business. A case mentioned is a 750-watt heater used twenty-four hours per day at $2 per month in connection, say, with an average consumption of 100 kw.-hr. for cooking, at 3 cents per kilowatt-hour, or $3 per month.

The Electrical Salesman's Handbook (Sec. 4, page 7), says it takes 550 watts to maintain 160 deg. temperature in a lagged tank and 1500 watts in an unlagged tank, so that the presumption must be that considerable water is used at a lower temperature than 160 deg. in case a 750-watt heater is used under ordinary conditions. This is in accord with the general practice, the gas men claiming that water at 110 deg. Fahr. is hot.

Readers' Views and Comments

The recent issue of the Salesman's Handbook, Sec. 1, page 28, says it takes 0.00244 kw.-hr. to raise 1 gal. of water 1 deg. Fahr., hence if we are to raise 15 gal. of water, say for a bath, from 60 deg. to 100 deg., it will require $40 \times 0.00244 \times 15 = 1.500$ kw.-hr., or 3 kw. capacity for thirty minutes, but we may begin to draw hot water if heater is used in connection with a tank in say fifteen minutes at the rate of 1 gal. a minute, half in storage and half coming through the heater. Hence, we say "15 gal. of hot water in fifteen minutes," or we may draw "5 gal. in five minutes" by waiting five minutes before the faucet is opened.

This is assuming about 97½ per cent efficiency, which probably cannot be realized, but this will not affect the practical adoption of the method in the household.

Experience gained from the operation of a large number of heaters in connection with ranges indicates that the average family can be supplied with the combined service with a consumption of 200 kw-hr. per month, although some use more, in one case between 600 and 700 kw.-hr. per month in a large residence.

Let us assume that the use of a water heater doubles the consumption of electricity, then at the 3-cent rate the average family will pay $6 per month for 200 kw-hr. per month as against the $5.63 for similar service noted in Mr. Webb's article, *i.e.*,

100 kw.-hr. range, at 3c	$3.00
450 kw.-hr. water heater capacity charge	.63
Water heater, flat rate	2.00
550 kw.-hr. at, say, 1c	$5.63

The logic of the situation is that enough energy is wasted by flat rate methods to provide all the hot water needed, do all the cooking besides, and then have something to spare.

The right kind of a water heater will give satisfactory service at regular meter rates for cooking. Of that there is no doubt.

RALPH J. PATTERSON,
Superintendent Central Maine Power Company.
Waterville, Me.

Dining-Room Rugs to Facilitate Use of Table Appliances

To the Editor of ELECTRICAL WORLD:

No one who has watched the development of the electric table appliance can fail to realize that its use is bound to be limited by the unsightliness of flexible cords dangling from an overhead fixture. On the other hand, cord connections to floor outlets encounter the obstruction of the rugs which cover most dining-room floors. The usual plan in such cases of ripping one of the seams of the rug for a short distance, and making an opening through which the cord or cords can be passed, has many objections, such as the rubbing contact with the cords, wear, difficulty of access, etc.

Why not, instead, have a rug with a center opening large enough to admit the center pedestal of the dining-room table; an outline rug, a border rug; or, better still, a *Home Electrical* rug.

Here is a chance for some live manufacturer, but if no rug maker can be found with initiative enough to make the first one, some live central station can order a few made up, get in touch with local architects, display it in its "model cottage," and in other ways give the idea an impetus in some large center that will force the rug manufacturers to follow.

The plan is suggested through your columns in order to insure a wider publicity than if proposed through any single concern or organization.

CORNELL RIDDERHOF.
New York City.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

C. LE MAISTRE

C. Le Maistre, general secretary of the International Electrotechnical Commission, who recently visited the United States as a delegate of the engineering standards committee of Great Britain to the meetings of the standards committee of the American Institute of Electrical Engineers, has been appointed secretary of the engineering standards committee of Great Britain.

R. E. Smith is now in charge of the sales department of the Mount Whitney Power & Electric Company, Visalia, Cal.

W. C. DeCelle has been elected president of the Yolo (Cal.) Water & Power Company, succeeding Roy M. Pike, recently resigned.

S. Bingham Hood, for many years distribution engineer for the Toronto (Canada) Electric Light Company, has resigned and entered the employ of the Northern States Power Company, Minneapolis, Minn., in a similar capacity.

R. E. Berger, who has been superintendent of the light and power department of the Toledo (Ohio) Railway & Light Company, has been appointed manager of the Mansfield and Ashland properties of H. L. Doherty & Company.

C. W. Bates, who has been instructor in electrical engineering in the Sheffield Scientific School of Yale University, New Haven, Conn., has resigned to accept a position in the instrument and installation department of the Philadelphia Electric Company.

M. L. Worrell of Meridian, Miss., has been elected permanent chairman of the Water & Light Society of Mississippi, recently organized at Jackson, Miss., by the superintendents, engineers and managers of the municipal water works and electric light and power plants from the various cities in Mississippi.

Charles B. Hole of Montclair, N. J., has been appointed president of the North Carolina Public Service Company of Greensboro, N. C., succeeding Bird S. Coler of New York, N. Y., resigned. The company owns and operates electric light and power plant and street railway systems in Greensboro, High Point and Salisbury.

H. R. Whiting has resigned as superintendent of the Carite waterpower, Porto Rico Irrigation Service, after two and a half years in this position, to join the operating staff of the Porto Rico Railway, Light & Power Company as superintendent of the latter's Comerio power stations.

F. C. Myers has joined the publicity staff of the Society for Electrical Development as trade press editor and also in direct charge of its highway lighting campaign. Mr. Myers has been for ten years identified with publishing work, and has won general recognition as a writer upon factory and power installations.

Trygve D. Yensen, research professor in the engineering experiment station of the University of Illinois, has accepted an appointment in the research department of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., and will develop there the vacuum process for producing iron for magnetic purposes.

T. E. Bibbins, local manager in the San Francisco office of the General Electric Company, has been appointed president of the Pacific States Electric Company, with headquarters in the same city, succeeding H. V. Carter, who recently resigned. It is announced that the general sales policy of the Pacific States Electric Company will not be affected by the change.

J. S. Kennedy has been placed in charge of electrical sales with headquarters at the factory of Landers, Frary & Clark, New Britain, Conn. Previous to two years' service as New England sales representative of the company, Mr. Kennedy was with the Edison Electric Illuminating Company of Boston for five years in its appliance department, acquiring a wide knowledge of the central station and merchandising fields.

C. R. Phenicie, general manager of the Wisconsin Public Service Company, Green Bay, Wis., has just been appointed vice-president of the company. Mr. Phenicie was graduated from the University of Kansas, and took postgraduate work at Armour Institute of Technology. Following a year's work as designer on circuit breakers and electric railway overhead material, he was erecting electrical engineer for the Glucose Sugar Refining Company, and later with the Westinghouse Electric & Manufacturing Company. In 1904 Mr. Phenicie accepted the combined position of electrical engineer and superintendent of motive power for the Chicago & Milwaukee Electric Railway Company, which position he held until he became associated with the Wisconsin Public Service Company.

JOHN A. CLAY

John A. Clay, the president-elect of the Colorado Electric Light, Power & Railway Association, is the general manager of the Western Colorado Power Company, with headquarters at Montrose, Col. Mr. Clay was graduated sixteen years ago from the engineering department of the University of California. His first position in the central station field was with the Independent Light & Power Company, San Francisco. Later he entered the employ of the Pacific Mail Steamship Company in its San-Francisco-to-China service. Shortly thereafter, however, he took up construction work ashore for the General Electric Company in the Northwest. Entering central station work again he was employed by the Tacoma Railway & Power Company and the Washington Water Power Company. Then for a period he was connected with the Hecla Mining Company in the Coeur d'Alene district. Since 1906 Mr. Clay has been with the Western Colorado Power Company of Montrose, remaining through various reorganizations.

John Van Ouwerkerk, formerly secretary and treasurer of the Falls Light & Power Company of Sheboygan Falls, Wis., has been appointed superintendent and manager of the municipal electric light, power and waterworks plant at Sheboygan.

C. W. Wendall, who since his graduation from the New Hampshire State College in 1909, has been employed by the Public Service Electric Company of New Jersey, has just been appointed instructor of electrical engineering at New Hampshire State College.

Obituary

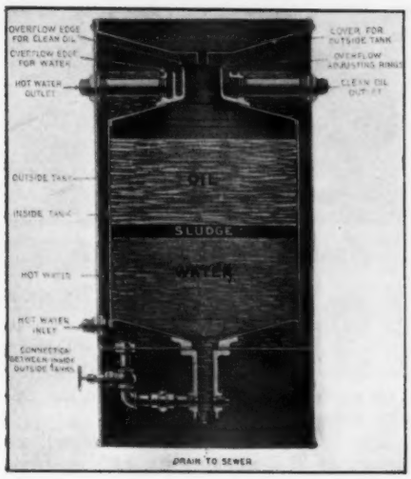
C. W. Bowen, president of the C. W. & R. M. Bowen Electrical Company of Providence, R. I., died of acute indigestion on Sept. 16 at the St. Johnsbury House, St. Johnsbury, Vt. Mr. Bowen was born in Providence in 1851. He was historian of the Rhode Island Society of Mayflower Descendants and a member of the Rhode Island Society of the Sons of the American Revolution.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

An Oil Reclaimer

To remove carbon and other impurities in oil and restore it to its original condition of quality, cleanliness and transparency, the De La Vergne Machine Company of New York City has designed and is now offering to the trade an oil reclaimer constructed as shown in the accompanying illustration. The method of clarifying the oil calls for a violent agitation of the dirty oil with a solution of hot water and a special coagulant, called "Oilite." The effect of this coagulant is not due to chemical action, it is said, but is purely mechanical, being based on the scientific principle of the relative surface tensions of oil and water. The foreign matter is precipitated in the form of a dense layer of sludge sharply defined from the pure transparent oil. The coagulant, which is insoluble in oil, and separates out completely, does not effect the oil, it is claimed.



SECTIONAL VIEW OF AN OIL RECLAIMER

The reclaimer is made up with a double steel shell, the annular space between the two shells serving as a water jacket for the inner receptacle. A continuous supply of hot water makes it possible to maintain a temperature of about 140 deg. to 160 deg. Fahr. in the oil under treatment. Where the reclaimer is used in connection with a stationary engine, the engine jacket water may be used and in other cases the oil may be heated with steam or by hot water taken from any hot-water system. The inner tank contains the oil to be treated. An equal amount of hot water is mixed with the dirty oil by temporarily opening the connection between the two tanks, and one pound of "Oilite" dissolved in hot water is added to each 4 gal. of dirty oil. The contents of the inner tank is then violently agitated for ten minutes. This may be accomplished by compressed air, if available, through a connection at the bottom of the tank. Otherwise it may be done by mechanical stirring and mixing. After agitation the mixture is allowed to settle for about ten hours. The dirt and impurities precipitated form a heavy, clearly defined layer below the clear oil, but above the dirty water. When the valve in the connection between the inside and outside tank is opened the clean oil rises and passes over the overflow edge for clean oil through the outlet pipe provided for the purpose. In order to provide an automatic stop of the overflow as soon as all clean oil has left the inner tank, advantage has been taken of the fact that oil is lighter than water. The overflow adjusting rings serve to fix this automatic stop according to the gravity and quality of oil. This is an important feature of the reclaimer, it is pointed out, because it is unnecessary for the operator to watch the apparatus while the clear oil is discharging.

Outdoor Metering Equipments

The accompanying illustrations show a type of meter equipment inclosed in a weatherproof casing and arranged for use with high-tension transmission lines where the expense of a substation is not warranted. These outdoor metering equipments have been developed by the Westinghouse Electric & Manufacturing Company for 60-cycle, polyphase service, for current ratings not exceeding 200 amp. and for voltage ratings from 11,000 volts upward.

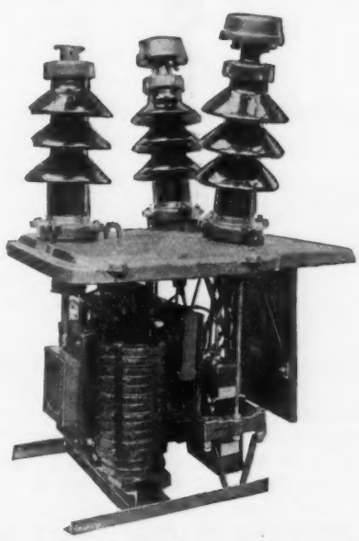


FIG. 1.—OUTDOOR METERING EQUIPMENT WITH CASING REMOVED

Each equipment consists of a standard polyphase watt-hour meter, two current transformers, a polyphase voltage transformer, and three choke coils, all inclosed in a sheet-steel case with cast-iron cover supporting three high-tension outdoor-type terminals. The sheet-steel case is subdivided into two compartments, one of which is filled with oil in which the transformers and choke coils are immersed, while the other serves to inclose the meter and meter panel. On the meter panel are also mounted two fuses to protect the voltage circuit of the meter and two calibrating links located in the current circuit of the meter. These calibrating links consist of fuse clips with a brass tube inserted instead of fuses. The meter may be read or checked upon opening the hinged door which covers the entire front of the meter compartment. The arrangement is such that the entire outfit, including meter panel, can be raised out of the tank without disconnecting meter leads. Three primary outlet terminals provide the necessary primary connections, one of the terminals serving as the common connection of the voltage transformer windings, while each of the other two terminals provide connection for one current transformer and one end of one of the voltage transformer windings. The current transformers each have two primary windings which may be connected in series or in parallel by connecting links in the weatherproof cap at the top of the outlet terminals. The polyphase voltage transformer con-

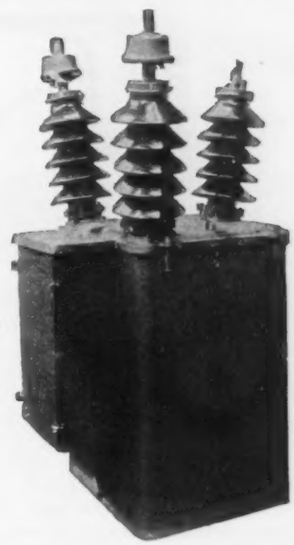


FIG. 2.—OUTDOOR METERING EQUIPMENT INCLOSED IN WEATHERPROOF CASING

sists of a three-phase core having windings on the two outer legs only, and is therefore equivalent to two single-phase voltage transformers connected in open delta. Choke coils are inserted between the voltage transformer windings and the outgoing leads, to protect the transformer windings against high-frequency disturbances.

Recording and Distant Type of Indicating Thermometer

The Brown Instrument Company of Philadelphia has placed on the market a recording thermometer for temperatures to 800 deg. Fahr. or 425 deg. C., which operates on the principle of the

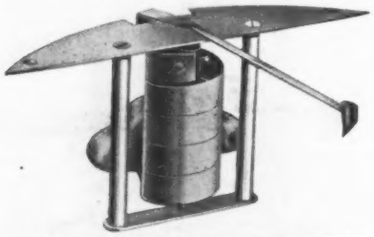


FIG. 1—RECORDING MECHANISM OF THERMOMETER

expansion of gas with change in temperature. A bulb of copper containing nitrogen gas under pressure is connected to a recording instrument by a small copper tube protected by flexible steel tubing. The recording instrument has a helical spring somewhat similar to that used in pressure gages, and the expansion of the gas in the bulb exerts pressure which is conveyed by the capillary tube to the helix, which expands proportionately. This helix is directly connected to a recording arm which marks on a record chart.

When a sufficient length of tubing is provided the recording gage can be placed as much as 100 ft. distant from the point where the temperature is measured. This permits its application in numerous processes where it is desirable to keep a constant record of

FIG. 2—DISTANT TYPE INDICATING THERMOMETER

the temperature on a chart. The Seth Thomas clock which revolves the chart is mounted directly on the front plate on which the chart revolves, which the maker points out insures alignment of the clock and chart plate. Attention is also called to the fact that the clips which hold the chart in position are mounted in the door so that when the door is swung aside these clips are automatically swung away from the chart,

FIG. 3—RECORDING TYPE THERMOMETER

permitting its easy replacement without interference. A device is furnished which raises the chart pen from off the chart automatically when the door is opened, and freeing the pen when the door is closed.

This instrument is also made in indicating form where it is desired to indicate the temperature on a dial instead of recording it on a chart. It is furnished with a number of different types of bulbs, either with threaded connection for insertion in mains and pipes, or with lead coating to withstand chemicals and acids.

A Pendant Fixture for Gas Filled Lamps

The lighting unit shown herewith is constructed in such a way that it acts as a semi-indirect bowl, while at the

A SMALL PENDANT LIGHTING FIXTURE

same time, according to the New York Gas & Electric Appliance Company, 569-571 Broadway, New York City, which is marketing this fixture, it is a direct reflector. The top shell conceals the perforated vent holes which allow heated air to escape, while a hole in the bottom permits the entrance of cold air. The hood, it is claimed, is designed to utilize gas-filled lamps in sizes up to 1000 watts. These units are made in two sizes, the smaller for 100 to 250-watt nitrogen lamps, with Edison base, and the larger for 300 to 1000-watt lamps, Mogul base. The fixture calls for little maintenance, it is pointed out, since it is so arranged that dirt cannot get into the globe.

Moving Electric Window Sign

The Arnold Electric Company of Racine, Wis., has brought out a window sign which is so arranged that it permits the user to display a moving message 30 ft. long in a 3.5-ft. space. The interior mechanism of the sign as shown herewith consists of a motor driving a train of rollers which pass a strip of tracing cloth over the face of

ELECTRIC WINDOW SIGN MECHANISM

the sign. Four 10-watt lamps behind the tracing cloth illuminate the sign to make it effective at night as well as in daylight. With the universal motor and all four lamps in operation the device consumes about 60 watts.

The sign in over-all dimensions measures 39.5 in. long by 9.25 in. high by 9.5 in. wide. Its net weight is 31 lb. A message film of any length from 6 ft. up to 30 ft. can be used with the sign. Arrangements have been made so that the film can be changed in a few minutes. One 30-ft. length of film, lettered to suit the purchaser, is furnished with each sign. Additional films can be obtained from the Arnold Electric Company, or blank films can be purchased and the lettering made by any sign painter.

Weatherproof Lamp Sockets

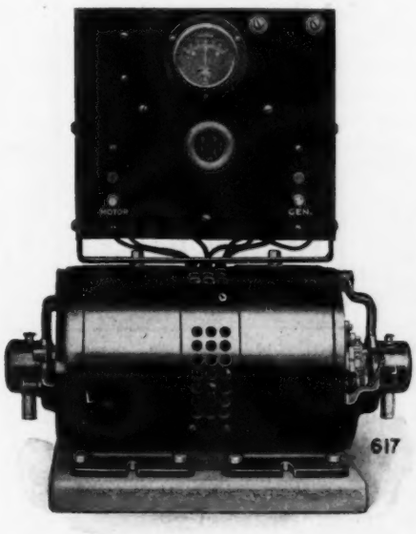
In the accompanying illustration is shown a suspension type molded mica weatherproof lamp socket for outdoor use and in damp places, which is a re-

MOLDED MICA LAMP SOCKET

cent product of the H. W. Johns-Manville Company of New York. These sockets are claimed to be practically indestructible, will not break or crack like porcelain, are weatherproof and possess highest insulating qualities.

Battery-Charging Motor-Generator Set

A battery-charging outfit has been developed by the Robbins & Meyers Company, Springfield, Ohio, which is made especially for charging automobile and motorboat batteries. The outfit is made in three sizes—80, 150 and 250 watts. The 80-watt size will generate current in voltages up to 8 volts, and the 150 and 250-watt sets up to 15 or 30 volts, as desired. The motors of these sets are furnished to operate from 115 to 230-volt direct-current circuits or 110 and 220-volt alternating-current circuits of 25 to 60 cycles. The 80 and 150-watt sets are light in weight and suitable for portable service. The 250-watt sets are not provided with the wooden base as they are built for installation in a permanent position. The sets are regularly furnished with a steel switchboard, which is mounted in the frame at the top. This switchboard is provided with an ammeter in the generator circuit which shows the charging amperes, a rheostat in the generator field to regulate the rate of charge, a push-button switch in both the motor and generator circuits, a fuse block with fuses in the motor lines and terminals for connecting the motor to the line and the generator to the battery leads. When the outfits are furnished without the switchboard the 80-watt and 150-watt sets are provided with 10 ft. of duplex cord with detachable plug on the motor side and with 10 ft. of heavy duplex cable with universal lead-covered test clips in the generator side for connection to the battery. These leads are brought out through heavy insulating bushings in the frames of the machines. The 250-watt sets without switchboard are provided with leads which are brought out



SMALL BATTERY CHARGING OUTFIT

through bushed holes in the frames and fitted with brass connectors. The 150-watt and 250-watt sets are furnished with a rheostat in the generator field for adjusting the rate of charge, but the 80-watt set without switchboard is not provided with a rheostat since it is designed to give a tapering charge to the battery and a rheostat is not essential.

An Electric Heater for Automobile Engines

An electric heater for automobile engines and radiators which can be connected to an ordinary lamp socket for use during winter nights in private unheated garages, is being manufactured by the Hughes Electric Heating Company, 215 West Schiller Street, Chicago, Ill. This device is of such a size that it can be placed in the hood of the car between the engine and the radiator. The body of the heater contains a rugged heating element which consumes 0.1 kw. and gives off just enough heat to keep the radiator from freezing and the engine from causing starting trouble, it is claimed. The hood of the car, however, should be blanketed in severe weather to confine the heat to the parts inside. This heating element is inclosed in a black enameled metal shell—shaped like and about the size

ELECTRIC HEATER TO PREVENT WINTER AUTOMOBILE STARTING TROUBLES

of an ordinary dry cell—which is perforated to allow for circulation of the heated air from within.

An Inexpensive Galvanometer of High Sensitivity

The latest addition to the galvanometer line of the Leeds & Northrup Company of Philadelphia is an inexpensive galvanometer of high sensitivity, shown here with cover removed. This galvanometer is intended for general laboratory use and is consequently not furnished with sensitivities as high as essential for extreme precision work. It is provided with removable suspensions so that replacements may be readily made. The magnet is made of special steel with pole pieces so shaped as to produce a radial field in order to reduce, as far as possible, the effect of foreign magnetic particles in the coil. The suspensions are of a special rolled silver strip. The mirror is 0.5 in. in diameter. In the accompanying illustration the knurled head on the left makes it possible to turn the coil for zero adjustment. The second knurled head is used to clamp the coil to prevent damage to its suspensions when the instrument is being moved. The galvanometer is inclosed in a cylindrical metal case, finished in black, with a large glass window in front. The instrument is mounted upon an insulating base supported upon three leveling screws. The manufacturer claims the

HIGH SENSITIVITY GALVANOMETER WITH COVER REMOVED

instrument may be easily leveled since the air gaps are large in comparison with the size of the coil. A level on the base facilitates in setting up the instrument.

A New Socket Cap

A socket cap that provides a suitable means of connecting armored cord to sockets has been produced by Harvey Hubbell, Inc., of Bridgeport, Conn. A threaded ring swivels around a split composition bushing shaped to the metal covering of the cord. As the threaded metal ring is screwed into the aluminum top of the socket cap the composition bushings are drawn snugly

KEY SOCKET EQUIPPED WITH STRAIN RELIEF CAP FOR ARMORED CORD

around the metal casing. This operation, it is claimed, relieves all the strain on the bare conductors attached to the binding screws. The accompanying illustration shows the porcelain key socket equipped with the special strain relief cap.

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

INQUIRY INTO RATES PAID BY DRY GOODS STORES

National Retail Dry Goods Association Sends List of Questions to Members in Effort to Collect Evidence for Lower Schedules

An inquiry among its membership concerning rates paid by dry goods stores for electrical energy has been made by the National Retail Dry Goods Association and the results printed.

Altogether about 140 replies were received up to the end of June, of which number the association was able to calculate the rate and average monthly consumption of ninety-six stores. The rates paid by these stores are shown in the accompanying table.

In presenting the result of this inquiry the association states that "undoubtedly many stores will be able to secure a lower rate through the information presented."

Such evidence as is contained in the accompanying table the association believes very powerful, for it states that if it only had to prove to the power companies that this or that rate is too high considering the quantity of energy used its task would be an easy one. The merchant, it is pointed out, would merely show the power company that his rate column on the table is higher than that of stores with a similar consumption, and down would come his rate. Among the difficulties to be met the report states are the public service commissions. However the association is of the opinion that it is quite likely that if fifty or a hundred stores would get together and collect information showing that certain rates were unreasonably high they could have them lowered.

The gist of the matter is to be found in the two following clauses which the association says the individual store can do whenever a rate is fixed or approved by a public service commission or city government: "First, it can make common cause with all other stores in its town or state and by collecting information proving that rates are too high can secure a revision, or second, under certain conditions the store can install its own power plant."

Under the entire report there is a plea rather indirectly made for isolated plant service. One statement is as follows: "Among the merchants who sent in reports there are several who are operating their own power plants, and the fact that these stores all have very low rates would naturally seem to indicate that every store should manufacture its own light and power if possible."

One feature that was very favorably recommended by the report was the use of a motor-generator set for lighting service, when the lighting rate was considerably higher than the power rate. One store that reported did this and since its motor-generator losses were 20 per cent this was assumed as a fair figure by the report which states that therefore, "any store whose lighting rate, is say 30 or 50 per cent higher than its power rate may well consider the advisability of installing one of these machines.

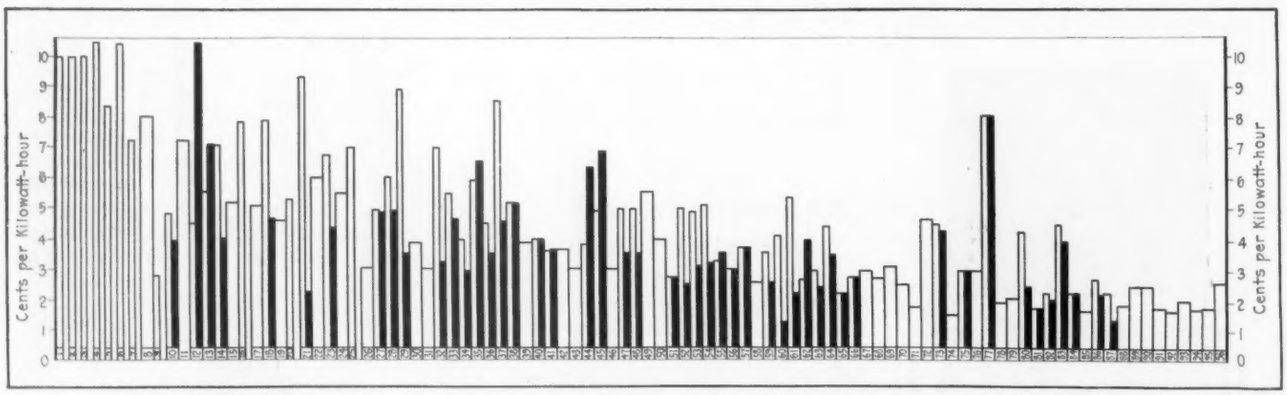
"Current for operating the motor which drives the generator will, of course, be metered along with other power current used by the store for elevators, cash carriers, fans, etc., and by thus increasing the amount of power current consumed, the store will probably be able to secure a lower average power rate."

Rates for each store are compared with those of other stores and recommendations are made to show some way to reduce the electricity bill.

The report concludes with the following remarks:

"The manufacture of electric power is a comparatively new industry, and it is not surprising that rates have not as yet been standardized. If the retail store had been in existence only twenty-five years or so, we should not be surprised to find different stores selling the same shoes at somewhat different prices. But to find one store selling a shoe at $2.56 while another store sold it for $9.75 would surprise investigators.

"No doubt the same conditions exist in the electrical power industry as in any other line of business. Some plants are so well managed that they can produce and sell power at a low rate and still make a fair profit, while others are so poorly managed that even the high price obtained for current is mostly eaten up by the high cost of operation. Then, too, there are probably a good many plants which manufacture current at a lower rate and sell it at a high rate and congratulate themselves on the fact that they get away with it which is perfectly natural.



RATES PER KILOWATT-HOUR PAID BY NINETY-SIX DRY GOODS STORES FOR LIGHT AND POWER SERVICE
White Stands for Light, Black for Power, Stores Arranged According to Consumption Increasing from Left to Right

"Retailers may not be particularly interested in the fact that these conditions exist, but knowing that they do exist—as our investigation indicates clearly enough —they will not have any hesitation about going after their respective power companies for sizeable reductions in rates."

Public Service Commission News

Oklahoma Commission

On complaint of the city of Mangum the Corporation Commission found the rates of the Mangum Electric Company excessive. An allowance was made under "contingencies and omissions" for the loss which would occur if the same quantity of material in the plant were again put into place. Only a relatively small allowance was made for engineering and superintendence in building the company's plant since in small towns of the size of Mangum similar plants have been built for years upon the same general plan, and sellers of equipment furnish complete specification for installation. The sum of $1,500 was held to be an adequate allowance, since this work may be performed by one man, to be hired at the rate of from $2,000 to $3,000 a year during a maximum time of construction of six months. The commission was of the opinion that an amount should be allowed for injuries to persons during construction equal to the insurance which would be required to be paid under the workmen's compensation act. No allowance, however, should be made for taxes during construction if an allowance is made for interest during construction, especially when there is no evidence that taxes were paid.

The evidence of the utility's expert as to the amounts that should be allowed for working capital and going value were given but little weight, since he had had very little practical experience, although having theoretical knowledge, had indorsed the inaccurate figures of other experts as to other items, and had testified in another case that a smaller allowance for working capital and going value should be included in the valuation of a larger plant with greater expenditures.

One-twelfth of the operating expenses of an electric light company, exclusive of taxes, was held to be sufficient for working capital. No allowance was made for going value, other than the cost of soliciting subscribers and making contracts, where continuous friction between the public and the operators have discouraged new business, and where there is no evidence of early losses.

All outside construction of an electric lighting plant, such as pole lines, transmission lines, transformers, etc., according to the opinion, should be maintained from year to year out of earnings, but there should be a depreciation fund for boilers, engines, generators, switchboards, etc., which may have to be replaced at one time.

Idaho Commission

A mutual public service corporation cannot claim exemption from the provisions of the public utilities act of the State of Idaho, and therefore it must first secure from the Public Utilities Commission a certificate of public convenience and necessity before it proceeds with the erection and construction of a telephone or other public service line. This important ruling, the first of its kind construing the relationship of a mutual public service company to the Public Utilities Commission since the enactment of the Idaho law, settles at an early date a question which later may become embarrassing. The commission proposes to extend its right of protection to the public where even public service corporations are involved.

The ruling was made in the case of the Mountain States Telephone & Telegraph Company versus the Project Mutual Telephone & Electric Company of Rupert. The Mountain States company complained that the Mutual company had begun construction of a telephone line, plant and system at Rupert without the authority of the Public Utilities Commission, and that such construction work was an infringement on its territory, and that its competitor had not secured a certificate giving it authority to build. In reply the Project Mutual company denied the allegation of the Mountain States company, and set forth "that it is a mutual company supplying telephone connection for its regular subscribed members who are stockholders of said company, and no other, and that it does not do business for compensation."

This allegation and answer clearly raised the question of a mutual public service corporation being exempt from the jurisdiction of the commission. Section 48 of the present public utilities act was directly involved. Provision A of this section says:

"No street railroad corporation, gas corporation, electrical corporation, telephone corporation or water corporation shall henceforth begin the construction of a street railroad, or of a line, plant or system or of any extension of such street railroad or line, plant or system, without having first obtained from the commission a certificate that the present or future public convenience and necessity require or shall require such construction."

In its order and opinion the commission says among other things: "The public utilities act applies to public utilities and public services therein described, and to this commission. The use of a public utility as applying in this State is a public use furnished for compensation within this State, and it is subject to the control, jurisdiction and regulation of this commission, and if such public utility is of a class specified in Section 48, above quoted, it is, of course, subject to the provisions of said section.

"It is clear from the record in this case that the construction and operation of defendant's telephone line is not incident to any other business carried on by the defendant. The defendant, as far as the issues in this case are concerned, was organized to carry on a telephone business of considerable magnitude. The fact that defendant is a mutual company serving its own stockholders exclusively does not itself place the defendant without the meaning of the term 'telephone corporation.' The business carried on by the defendant cannot be considered as being of a private nature, as in the case of a line constructed and operated primarily for some individual's other business enterprises. The business of the defendant is of a magnitude to make it general and public in its nature, and the service rendered is a public service.

"This construction of the statute we believe to be in the light of the public good or welfare so as to give effect to the statute as a whole, and to carry out the general policy laid down by the statute and the evident intent of the Legislature in enacting the statute.

"It being the prime purpose of the public utilities act to substitute regulation for competition, and to protect the public on the one hand and the investor on the other, it appears to this commission that the object and whole policy of the statute would be defeated by permitting competition to the extent contemplated by the defendant under the guise of a mutual corporation. The commission finds that the defendant is a telephone corporation as that term is defined in the public utilities act, and as such is subject to the operation of the said act and to the jurisdiction of this commission, and that the defendant has not lawfully commenced operation or construction work."

Liability of Light Company for Damages After Transfer of Property.—Where a gas, electric light and power company, after an explosion inflicting injuries for which it is liable in damages, makes a conveyance, *omnium bonorum*, to a new corporation under circumstances which warrant the conclusion that the new company is merely a continuation or reorganization of the old company, the person injured, it is held in Wolff versus Shreveport Gas, Electric Light & Power Company (L. R. A. 1916 D, 1138), may recover against either corporation, or both.

Linemen Not Using Ordinary Care Not Entitled to Damages.—The question of awarding damages for injuries received by linemen for defective and poorly insulated lines has been a recurrent one this year before the higher tribunals of the nation. The most recent case is that of Zachry versus the City of Madison argued on appeal before the Court of Appeals of Georgia, which held (89SE594) that where a lineman of a telephone company, who having had several months' experience in its service in that capacity, aged about 20 years, and not lacking in intelligence, was injured by contact with electric light wires, which had been strung on poles in close proximity to the poles of the telephone company, and from which the insulation had been apparently worn off near the telephone pole which the lineman climbed that he knowing, or being able to know by ordinary diligence, that the wires were so exposed, was not entitled to recover on account of such injuries from the municipality owning the wires.

Easement Rights in Raceway Grant.—If from the terms of a grant of a raceway right-of-way there is manifested a clear intention that the grantee shall enlarge the space originally occupied by him in accord with the demands of the future, such enlargement will be upheld, according to the Supreme Court of Oregon in Patterson versus Chambers Power Company (159P568). Under an indefinite grant of a right-of-way for raceway, with nothing to indicate that it may be changed or enlarged in the future, the first location and user fixes the limit of the grant. Adverse possession of grantor or his successors does not run against the right to enlarge a raceway as required by future necessities, at least until the right to enlarge has accrued, since until that time that grantee cannot object to use of land not needed by him, and is under no duty to warn the fee holders not to use such land because of his future and contingent rights. The grant of a raceway, with right to dig it as wide and deep as may be necessary to supply future defined needs, does not include or confer the right to maintain the ditch at its then depth by dumping upon adjoining property filth and silt which fortuitously accumulates on its bottom. The owner of a raceway right-of-way for power purposes had no right to use the ditch for the purpose of floating logs, timber, or cordwood, without protecting its sides from the consequent erosion.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Abandonment of Right to Use Streets.—Where the right to lay electrical conductors under the city streets was abandoned by a non-user for over 20 years, the city's revocation of such permission did not impair a contract obligation, the Court of Appeals of New York decided in New York Electric Lines versus Gaynor (113NE518).

Care Required by Telephone Company Whose Lines May Come in Contact With High Tension Lines.—It was held by the Supreme Court of Oklahoma (159P447) that where the wires of a telephone company are so constructed and maintained that they are apt to sag and come in contact with the wires of a traction company, highly charged, the telephone company owes to its subscribers the highest degree of care to prevent injury to the property or to the life of its subscribers, and if it fails so to do and injury results proximately therefrom, the company is liable.

Liability for Damages Inflicted by Wires Blown Down at Night.—In order to hold a corporation operating an electric light plant liable in damages for injuries inflicted by its high-voltage wires blown down at night in a storm and brought in contact with telephone wires, it is held (L. R. A. 1916 D, 1064) that it should be shown either that the poles were rotten or the installation otherwise defective, or that the company was guilty of laches in the matter of finding out that the wires were down or in the matter of shutting off the electricity after obtaining that information.

Negligence of Employee.—There is a duty resting upon the servant to avoid injuries to himself, and, if he fails to do so, that does not constitute negligence on the part of the employer, and it is a self-evident proposition that there can be no contributing negligence by a servant unless there is evidence tending to show primary negligence on the part of the master, according to the Maryland Court of Appeals (98 A 206) in a case appealed by the Westinghouse Electric & Manufacturing Company. The company was installing apparatus in a Baltimore plant. The foreman's head, in the course of the work, came in contact with a switch charged to 13,000 volts and from the effects he died. In a suit for damages it was brought out that the foreman besides being experienced was further cognizant of the attendant danger for he had caused a "danger—13,000 volts" sign to be placed in the cell. The court held that the deceased was negligent and met his death by no negligence of his employer.

Conveyance of Right to Overflow Certain Lands Does Not Include Other Lands of Grantor.—It was held by the Supreme Court of South Carolina (89SE552), that where a landowner granted to a power company the right to overflow certain lands "within contour line 110," containing about 22 acres, and the company raised its dam to less than the height that would overflow such land, but which damaged other lands of the grantor, not by overflow of back water, but because the filling up of the river caused slower current in the creeks, causing deposit of sediment, raising creek beds, which prevented drainage of the other tracts and rendered them unfit for cultivation, the company was liable for the latter damage, although it had not raised the water in the river to "contour line 110."

Sufficient Reasons for Condemnation by Power Utility.—In condemnation proceedings, petition by a power company alleging the purposes for which it was organized to be the construction of an electric power plant for the use of water power that the power will be used for pumping water appropriated and to be appropriated on arid and semi-arid lands, and also in the operation of industries and to furnish heat, light and power was held by the Supreme Court of Montana (159P408), in the case of Interstate Power Company versus Anaconda Copper Mining Company, sufficient under the law without alleging a present or prospective demand for the products of such power company. Evidence as to the practicability of power plant and the method of its installation were held to have been properly excluded as having no bearing on the amount of damages.

Death by Lightning an "Act of God."—A peculiar case in which the prominent engineering firm of J. G. White & Company was involved was recently decided by the Supreme Court of South Carolina (89SE564). A man named Sloan was installing some apparatus in an incompleted power house when lightning struck the line which was to connect the house. The line was not continuous and one end had been wound around a bushing on the side of the power house, which, it was brought out, was made of sheet iron. Sloan was killed and suit brought against the construction company on the charge that the line should have been properly grounded. The court held that the defendants knew whether the lines were properly grounded or not, but when they alleged, as they did, that Sloan met his death by what is legally known as a *vis major*, and that therefore they should be acquitted, the answer of the law is that they are not excused unless the *vis major* was the sole operating cause. According to the court: "The gist of it is that the 'Act of God' means in law, not only a *vis major*, but a *vis major* uncoupled with negligence. If the defendants had stopped with proof of death by lightning that would have excused the killing; they had to show that such was the sole cause, in order to escape the consequences."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Course in Public Utility Investments.—The Wall Street branch of the New York University, co-operating with the American Institute of New York, will give at 25 Broad Street, New York, commencing Oct. 6 a course in Public Utility Investments by Dr. Thomas Conway, Jr., professor of finance, Wharton School of Finance and Commerce, Philadelphia, Pa. It will be an advanced course, especially designed for men engaged in the financial field.

Effect of Dry Heat on Rubber Insulation of Wire.—Numerous tests have been made by the United States Bureau of Standards in connection with an investigation to determine the effect of dry heat on the physical properties of the rubber insulation of wire. This work is being carried out in collaboration with the testing department of the Pennsylvania Railroad Company and other laboratories identified with the American Society for Testing Materials, the object being to develop an accelerated test for insulated wire that will indicate the probable life of the wire insulation under normal service conditions.

Byllesby Electric Properties Outgrow Gas Properties.—Increasing gas and electric outputs point to a healthy condition of the territories served by the properties of H. M. Byllesby & Company. Since Jan. 1, 1916, this company reports gas output increasing at a rate of approximately 8 per cent corresponding to periods of a year ago and an increase in electric output ranging from 10 per cent to 18 per cent. In many localities business has grown to such an extent that production facilities have had to be increased. At the present time the companies are reporting weekly gains of 600 or more electric customers and 250 to 300 gas customers.

A Trouble Man's Duties Defined.—The Minneapolis General Electric Company has started a system of bimonthly examinations for trouble men. Among the questions asked is, "What are your duties?" One of the first answers secured in reply to this question is so comprehensive and expressed in so few words that it is considered by the company to be almost ideal. The answer was: "My duties are to advance the present high standing of the company in the minds of the people, to render cheerfully any service that may be required of me, to treat everybody with the highest courtesy, to protect life and property, to maintain service, to repair customers' wiring and appliances where possible, to practice economy and efficiency, and to call the office frequently."

Cost of Service Analyses.—The Oregon Society of Engineers, Portland, Ore., has published a paper by Clyde B. Aitchison, entitled "Cost of Service Analyses in Public Utility Rates Cases." The paper is of such merit that the society is desirous of giving to it a wide circulation.

Society Formed to Promote Cheaper Rates.—To protect the public from losses through erroneous gas and electric meters is one of the purposes of the Electrical League of Greater New York, incorporated a few days ago. It is a non-stock corporation and has for another purpose promotion of cheaper and more equitable rates.

Daylight Saving Lighting Loss Small.—At a recent meeting of the Massachusetts Street Railway Association, R. S. Hale, superintendent of the special research department of the Edison Electric Illuminating Company of Boston, presented a paper embodying his personal views on daylight saving. He said: "At first sight it might seem as though daylight saving by means of false clocks would mean a loss of lighting income, but my judgment is that it will be a very slight loss indeed. This is because the power business, the street lighting and the all-night lighting will none of them be affected, and while there may be a slight loss in the evening there will be a gain in the early morning which will help balance this. Further, the indications are that the change of hours will help to cut down our so-called peak and fill up our so-called valley, and thus reduce our expenses by as nearly as much or even by more than the reduction in income. I feel very sure that the difference either way will be so slight that it can hardly be measured and that the electric light companies are not warranted in bothering in any way about the proposed change."

Boston Edison Defines Dwellings and Apartments.—To avoid confusion in the writing of service orders and other work, the Edison Electric Illuminating Company of Boston recently posted definitions of dwellings and apartments for the benefit of the staff of the sales department. A building occupied as a habitation by one family is defined as a dwelling, an apartment being designated as a building inhabited by two or more families. Buildings divided vertically into single habitations, even though they may occupy a single block, are considered dwellings; while buildings divided horizontally are called apartments. An apartment building may have one entrance and one street number for all the suites in it, or it may have separate entrances and separate street numbers for each suite, but it is still an apartment building. Many two-apartment houses in Boston have two doors and two street numbers, one for the first and one for the second floor. These buildings are apartment houses, and each suite on the second floor is denoted "Suite 2." In such cases the street number of the first floor suite has no "Suite 2" designation and the street number of the second-floor suite has no "Suite 1" designation.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

New York Jovian Open Season.—The first meeting of the fall and winter season of the Jovian League of New York City was held at Browne's Chop House last Wednesday noon.

Electric Power Club Meeting.—The next meeting of the Electric Power Club will be held at the Homestead Hotel, Hot Springs, Va., on Nov. 15, 16, 17 and 18. C. H. Roth, 1410 West Adams Street, Chicago, is secretary.

Electric Railway Manufacturers' Meeting.—The annual meeting of the American Electric Railway Manufacturers' Association will be held in Atlantic City, in the Park Avenue room of the Marlborough-Blenheim Hotel, on Wednesday afternoon, Oct. 11, at 4 o'clock.

San Francisco Section A. I. E. E.—At the first meeting of the season held at the Engineers' Club on the evening of Sept. 22, the subject was "The Application of Electricity to Gasoline-Driven Automobiles." H. S. Clarrage, of Vance, Clarrage & Company, presented a paper on "Entz Transmission" and H. A. Hussey read a paper on "Electric Starting, Lighting and Ignition as Applied to the Automobile."

Dallas Electric Club.—Directly after the regular luncheon meeting on Sept. 22 the members of the Dallas Electric Club and Jovian League visited the Armstrong Packing Company's plant. On Sept. 29, W. D. Schnauder, superintendent of power of the Texas Power & Light Company, gave a practical demonstration of the use of a high frequency oscillator in testing high voltage insulators. This oscillator is desired for use in testing for voltages up to 100,000.

Education Extension Work of Schenectady Section of the Institute.—During the coming winter various opportunities for study will be available to local and national members of the American Institute of Electrical Engineers residing in and near Schenectady. Union College will offer courses in mathematics, physics, chemistry and economics to graduates of technical colleges and others whose previous training will enable them to follow the work. Each course will be given at the college one evening per week. The tuition will be $10 per course. Registration officially closed on Oct. 5. In addition, a special course is being considered at the suggestion of the Institute. This will teach the elements of the logical and concise formation and arrangement of business letters, instructions, reports, contracts and specifications. Tentative plans already have been made for it.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

ELECTRIC DENTAL OUTFITS SHOW GOOD DEMAND

Electric Motors Fast Superseding Old Foot-Power Machines—Manufacturers Preparing for Permanent Increase in Business

Electrical apparatus is fast gaining a foothold in dental offices. The electric motor for drilling, smoothing and polishing is superseding the old foot-power apparatus. Many electric-heating appliances are now being used where oil or gas heaters were formerly used. It has not been difficult, it is understood, to educate dentists to the value of electrical outfits, particularly the younger men. There is, herefor, now a larger demand for this kind of equipment than at any previous period, and it is known that certain manufacturers are preparing in their factories for a permanent increasing business in these lines.

Prices have been advanced to cover the increased costs of raw materials, labor and to some extent increases in selling expenses. Deliveries generally are longer owing to the difficulty in obtaining materials and certain classes of skilled labor.

SIMPLIFICATION OF DISCOUNTS

Increasing Costs Forced Raise in Price Which Took Form of Omitting Discounts One by One

One of the benefits occurring from the European war which will undoubtedly have a profound effect upon the electrical industry has been the simplification of discounts. The discount evil has forced its way into practically every trade. There was one basic discount and after that the buyer took what he could.

Prior to the war the manufacturer offered to the jobber a string of discounts that often were astonishing. The present practice, especially on wiring materials, is for a single discount.

The rapidly increasing values of raw material on the one hand and increased labor costs on the other, by forcing higher prices of the finished product have been the reasons back of this reform. In increasing the prices, however, manufacturers were careful not to increase the list. That remained unchanged. Instead one of the discounts to the jobber was eliminated. At the next increase another discount was eliminated and so on until but a single discount remained.

In some cases this final discount is even lower than the old basic discount, in others it is the same as the old basic discount; but in quite few cases it is approximately equal to the old first and second discounts.

Thus the old jobbers' discounts on general supplies, etc., were 50-15-10-5-5 and now the discount is 47.5. Those on snap switches, were 50-10-16 2/3-5 now it is 47.5. On cut-out material they were 70-10-10-10 and now all but 70 is taken off. Fuse material used to be quoted at 75-10-10-10 off, but now it is 62. Conduit two years ago was sold on the basis of 50-10-10-10-10-10-10-10-10-10 off and now the discount is 54. Sockets that were quoted at 70-10-10-10-10-10-10-10-10-10-10-10 are now quoted at 80 off. In this last case, which is the most glaring of all under the old system, the jobber's total discount was 92.2 off. Thus the loss to him is but a little more than 12 per cent. The increase in price, therefore, has been slight but the simplification of discount has been considerable.

Under the old system, unless there was prepared a table before hand, the trade had considerable difficulty in arriving at a net price, all of which is now past. To the manufacturer there is a decided advantage in the new discounts in that the chances for a mistake in quoting a net price to the trade are greatly minimized.

OUTDOOR SUBSTATIONS INCREASE

Lively Demand Is Had for Pole-Top Switches and Other High-Tension Line Apparatus

A very large volume of business is being handled by the manufacturers of outdoor-type substations and high-tension line equipment. There is apparently a decided tendency toward utilization of this type of equipment for the larger substations and a considerable part of the increase in demand is as a consequence for the larger units. The outdoor stations are also being used more and more extensively for the larger industrial plant substations. Particularly is this true in connection with the great activity of the steel mills which are making continuously more extensive application of electrical equipment, which venture in turn has created an unusual demand for switching stations and high-tension busbar supports, disconnecting switches, choke coils, fuses, etc. The demand for pole-top switches has likewise greatly increased, due to the fact that central station men are realizing the need and advantage of sectionalizing high-tension lines.

Manufacturers of this class of equipment have increased their plant capacity and have been working two shifts of men, and would work three shifts if it were possible to secure competent labor. Porcelain and malleable-iron fittings have delayed shipments somewhat, although for the most part rather prompt deliveries have been maintained. Prices have advanced on the average from 20 to 30 per cent because of labor and material cost increases, but in this field as with the electrical manufacturers generally, the prices have been maintained as nearly normal as possible in the face of enormous increases in raw material prices, in a loyal attempt to take care of their customers. And it is said that manufacturers this year will not make as large a percentage of profit on the gross business as usual, because of this condition in the raw material market.

METAL MARKET STRONG

Immense Foreign and Domestic Buying of Copper and Steel Forerunner of Higher Prices

Conditions in the metal market are fast approaching the state that obtained last spring when prices were at their height. Deliveries for the remainder of the year can be had on but a very small amount of metal and there is every indication that 1917 will be a year of maximum production.

Following the placement by the British Government toward the end of September in this country of an order for 200,000 long tons of copper, the largest single order of copper ever placed, at close to 27 cents a pound, producers predicted that copper would undoubtedly pass the 30-cent mark before the year closed, and that the May figure of 31 cents would not long stand as high. Market quotations now place electrolytic for Oct. at 28⅝; for Nov., 28¼; Dec., 28; first quarter 1917, 27⅛. These prices, however, are nominal and are finding neither buyers nor sellers. During the past week there has been evidence of a number of sales of small quantities of copper for prompt delivery at 29 to 30 cents.

Many large domestic buyers, including a number of prominent electrical manufacturers and wire mills, are

in the market for quantities of copper, and quotations are being asked for deliveries up to the end of 1917. These manufacturers have anticipated higher prices and difficulty in obtaining the red metal and are taking no chances. When it is understood that orders calling for six months delivery are ordinarily very rare, the conditions under which the trade is laboring will be appreciated.

Steel prices have advanced on shapes, and an advance on bars and plates, it is understood, can be expected to follow shortly. A number of large domestic buyers not willing to wait longer have brought this condition about by rushing into the market with orders.

WESTERN ELECTRIC TO MAKE $1,000,000 PLANT ADDITIONS

Gross Sales for Current Year Will Reach $100,000,000 —Biggest Yet in Company's History— Orders Exceed Production

Western Electric gross for the year to Dec. 31 will reach $100,000,000. The previous biggest year gross was $77,000,000. This refers to actual shipment of goods to customers. The incoming orders booked will be very much greater than this amount. While the Western Electric Company has no war orders, it has felt the effect of the war by limitation of raw material supplies on the one hand and abnormal demand for its products on the other.

The directors recognize the fact that the present conditions are entirely abnormal; at the same time the pressure is here and cannot be entirely ignored. As a result, they have authorized further plant additions which will call for the expenditure of nearly $1,000,000. The Western Electric Company is employing 23,000 people.

RUSSIAN ELECTRICAL MARKET

Trade Now Looking to the United States to Supply Needs Formerly Supplied by Germany

Much has been written by writers in this country concerning the opportunity of the American manufacturer in the Russian market. An article, however, full of significance to the American manufacturer of electrical products appeared recently in the Russian electrical journal, the *Elektrichestvo*, in which it was pointed out that imports of German electrical goods into Russia increased from a value in 1909 of $3,500,000 to a value in 1913 of $8,500,000. The war, however, forced Russia to seek other suppliers. As her ally, Russia turned to Great Britain, but found that country unwilling and unready to develop the great Russian market.

Russia now, the journal states, is looking to the United States to furnish the Russian nation with electrical machinery and electrical products. Already the United States, it is pointed out, has profited by securing orders for considerable quantities of telegraph and telephone apparatus and many tons of copper wire. There is a strong demand for small motors of from ⅛ to 4 hp., for educational electric appliances, for x-ray apparatus, and for every kind of electrical material. A few weeks ago, it was impossible to purchase a single battery cell in the whole of Petrograd, and there is a feeling that the Russian market can absorb huge quantities of supplies in the future.

Russia, according to the journal, wants Americans to take the place formerly held by the 150,000 German merchants. Three-fifths of Russian capital has been offered American firms if they will contribute the other two-fifths in order to establish factories in Russia. Continuing, the journal points out that the large field which Russia offers for hydro-electric engineers and factories is shown by the fact that in the European Russia, including Finland, and in the Ural and the Caucasus, the utilizable hydraulic power is estimated at about 10,000,000 kw., while the amount utilized is less than in any other country in Europe. In round figures, around 200,000 kw. is developed, of which 1.8 per cent consists of small installations.

FIRM MARKET FOR STOKERS

With Present Business Above Normal, Manufacturers Are Optimistic Regarding Future

The volume of business in mechanical stokers now under way is considerably above normal. Incoming orders, it is understood, are slacking off somewhat at present, but this is believed to be seasonable and by no means permanent. It is the general belief of manufacturers in this line that prospects for the future are good. In addition to the present marked industrial expansion of the country it is pointed out that the art is young and growing rapidly. Present business was undoubtedly first stimulated by war orders after which orders from factories engaged in manufacturing more peaceful products followed.

Prices have advanced in some instances 20 to 30 per cent. This of course is owing to the advance in manufacturing materials and labor. Because of the difficulty in obtaining sufficient quantities of these two latter items at specified times, stoker deliveries have necessarily been delayed.

Credits and collections have been satisfactory. Stoker business is for the most part confined to comparatively large corporations of recognized standing, so that there is seldom any trouble on account of credit.

SELF-LUMINOUS COMPOUND FOR SWITCHES AND SOCKETS

The New Radium Paint to Be Used on Line of Switches Soon Ready for Market—Luminous-Headed Screws for Switch Plates

One of the large manufacturers of switches, sockets and supplies is now preparing to bring out a line of electric light switches and sockets pointed with a self-luminous compound which will render their location visible in the dark. A "radium" paint will be used, similar to that already recently employed on luminous dial watches, compasses, etc. This paint is continuously self-luminous, and, it should be noted, is to be distinguished from the luminous paints and pull-chain balls which have been on the market for some years, which require exposure to strong light to make them luminous in the dark for a period of several hours.

The base, zinc sulphide, is the same for the new self-luminous paint as for the older phospherescent paint which absorbs light and then gives it out again, shining with a greenish or bluish glow in the dark. The new paint, however, contains a small quantity of radium bromide, the alpha-particles of which, continuously bombarding the crystals of the sulphide, render it luminous in the dark with a pale greenish glow of about the intensity of a rubbed phosphorous match. By increasing the quantity of radium compound included in the paint the more brilliant can this phosphorescent glow be made. On aeroplane compasses used by the European armies, the luminous compound employed is of such intrinsic brilliancy that its glow can be seen even in contrast with twilight. Such a high mixture of radium compound, however, rapidly disintegrates the zinc sulphide, so that the life of the paint may be barely twelve months. In the intensity to be used on the new switches, which has been found most practical for average use on watch dials, etc., the figures are readily visible in a darkened room, and such paints have an assured luminous life of ten to fifteen years, if not longer.

It is proposed to tip the switch push buttons with this luminous compound, so that when entering a darkened room the user can quickly find the button, press it, and secure electric light.

In order that ordinary flush switches already installed may be made luminous, the electrical manufacturer referred to has devised the ingenious expedient of luminous-head screws which can be used to replace the present screws, giving visible points of luminosity by which the switch can be located in a darkened room.

The cost of the making and applying the self-luminous paint is, at present market prices of materials, about $1 per square inch. At this rate it is expected that the extra cost of equipping an ordinary electric light switch will be from 20 cents to 30 cents.

Manufacturing and Industrial

Henrici, Kent & Lowry, engineers, Kansas City, Mo., have moved from their former location at 715 Reserve Bank Building to 222 Commerce Building.

Wm. Mueller & Company have opened an office in room 1729 McCormick Building, Chicago, Ill., as sales representatives for R. J. Carney & Company, of Grinnell, Iowa.

The Federal Sign System (Electric) has moved its New York office, combining it with its showrooms and factory in very much larger quarters at 627-649 West Forty-third Street.

William Taylor, 203 Electrical Exchange Building, 136 Liberty Street, New York, has been appointed the New York sales manager of the Stoneware Electric Stove Works of Dover, N. J.

William Miller Tompkins has been made the Philadelphia representative of the Ward Leonard Electric Company of Mount Vernon, N. Y. His address will be 4813 Haverford Avenue, Philadelphia.

G. R. Veeder has been appointed manager of retail sales for the Wood Dual Power Car, Chicago, Ill. For three years he was Chicago sales manager for the Anderson Electric Car Company, makers of the Detroit Electric.

The Union Metal Manufacturing Company, Canton, Ohio, has removed its New York office, in charge of William A. Daunt, from the Country Life Permanent Exposition, Grand Central Terminal, to 31-33 East Twenty-seventh Street.

Brass Mills Cause Delay in Flashlight Deliveries.—The French Battery & Carbon Company has announced that owing to the failure of brass mills to make contract deliveries of sheet brass, cigarette type cases will not be ready for delivery until Nov. 1, 1916, and number 33 lighting batteries will not be ready for delivery until Feb. 1.

New Buffalo Location for Western Electric Company.—The Western Electric Company has moved its offices and showrooms in Buffalo from 98 Terrace to 709-11 Main Street. The new location, with two large show windows fronting on two streets, affords splendid display facilities. J. W. Tabb is the manager.

Fixture Manufacturer Increases Factory Space.—The Mohrlite Company of Urbana, Ohio, manufacturer of direct, indirect and portable electric fixtures, is moving into a new 60 x 100-ft. factory. In its new home this concern will occupy three times the floor space of its present quarters. This company moved its factory from the Pacific Coast to Urbana last January, and since has outgrown the space taken at that time. A part of the increased business is attributed to orders received from the following foreign countries: Sicily, Norway, Australia, Japan, Hawaii, England and France.

General Vehicle Company Moves Chicago Office to New Quarters.—The Chicago sales office of the General Vehicle Company has been removed from the Otis Building to quarters on Automobile Row at 1621 Michigan Avenue. Here the company will have an office and showroom 43 ft. by 105 ft. in which truck chassis will be exhibited, and a room back of this 400 ft. by 43 ft. where a large stock of parts will be maintained. There is also sufficient space for a service station which the company may install at a later date. The Chicago manager of the General Vehicle Company is C. W. Squires, Jr.

Shortage of Freight Cars.—Conditions which are steadily becoming more acute have recently prompted the Interstate Commerce Commission again to call attention to a threatened shortage of freight cars and to urge the adoption of all possible steps to alleviate conditions. The commission urges upon both carriers and shippers the necessity for close supervision of the methods of loading, unloading, and moving of cars to secure the fullest possible use of all available equipment. The commission emphasizes the advisability of shippers securing the prompt and full loading of cars, and of consignees exercising the same degree of promptness in their unloading and release. It is urged that individual shippers and their associations and the carriers co-operate in this matter in order to avoid, so far as possible, the delays consequent upon a general car shortage.

Bosch Magneto Company Builds Another Addition.—The recent big addition to the extensive Springfield (Mass.) works of the Bosch Magneto Company is to be further augmented by a large addition providing more than 60,000 additional square feet. Ground has already been broken for the new building, and its completion will be rushed to the utmost in order to be able to take care of the increased demand for Bosch products. The addition is to be a single story building with a saw-tooth type of roof providing the maximum of light and ventilation. When this second addition is completed, there will be more than 130,000 sq. ft. of manufacturing space which will have been added to the Bosch works during 1916.

G. L. Simonds & Company, Chicago, Ill., has announced a change in name. In the future the company will be known as the Vulcan Fuel Economy Company. The corporation simply adopts a new name. The personnel and policies of the organization remain the same. The only change, in addition to that of the name, is an increase in capital, the better to handle the company's growing business. According to the announcement a number of factors led to this change, chief among which is the great increase in scope and growth of the business. When the company was incorporated in 1909 the name of Simonds was selected because Mr. Simonds for many years personally had handled much of the selling end of the Vulcan soot cleaner business. The purpose of connecting the name "Simonds" and "Vulcan" it is felt has been largely satisfied in the time that has gone by and now a more fitting name for a larger organization is in order. Another reason for this change is that the name G. L. Simonds & Company is not at all descriptive.

Active Trade in Union Metal Standards.—The Union Metal Mfg. Company, Canton, Ohio, reports active work by municipalities in the installation of ornamental lighting standards. During the past month a contract was secured for an installation at Allentown, Pa., which calls for posts of a rather unusual design, in that each will be furnished with an ornamental flower bowl mounted just above the middle of the post body. It is said that Allentown is the first city to resort to this esthetic feature in connection with a general street-lighting standard although various designs have been worked out for parks and boulevards. The standards will be equipped with General Electric Novalux fixtures for type C lamps. Another recent order has been placed by the city of Amsterdam, N. Y., which includes 101 ornamental standards with General Electric Novalux fixtures for type C lamps. The installation for Canton, Ohio, mentioned on page 475 of the Sept. 2 issue of the ELECTRICAL WORLD, will consist of 500 Union Metal pressed steel standards, approximately 100 of them being equipped with General Electric luminous arc lamps and the remainder with 250 and 400-cp. type C series lamps. Another installation of interest is being carried out under the auspices of the Eastern States Agricultural & Industrial Exposition, Inc., at Springfield, Mass. Ornamental standards and luminous arc lamps will be used for lighting the boulevards and grounds of the exposition.

NEW YORK METAL MARKET PRICES

	Sept. 26 Selling Prices Bid	Sept. 26 Selling Prices Asked	Oct. 3 Selling Prices Bid	Oct. 3 Selling Prices Asked
Copper	£ s d	£ s d	£ s d	£ s d
London, standard spot	116 0 0		119 10 0	
Prime Lake	28.00	to 28.50†	28.25	to 28.50†
Electrolytic	28.37½	to 28.62½†	28.50	to 28.75†
Casting	26.62½	to 26.75	26.50	to 27.00†
Copper wire base	33.00†		33.00†	
Lead	7.00		7.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	15.00		15.00	
Spelter, spot	9.05	to 9.30	9.55	to 9.67½
Tin, straits	38.62½		38.50	
Aluminum, 98 to 99 per cent	61.00	to 62.00†	61.00	to 62.00
OLD METALS				
Heavy copper and wire	23.00	to 23.50†	22.50	to 23.00†
Brass, heavy	13.00	to 13.25†	13.25	to 13.50†
Brass, light	10.00	to 10.50†	10.00	to 10.50†
Lead, heavy	5.87½	to 6.00†	5.87½	to 6.00†
Zinc, scrap	6.25	to 6.75†	6.50	to 6.75†

COPPER EXPORTS

Total tons to Oct. 3 14

†Nominal.

Corporate and Financial

Boonton (N. J.) Electric Company.—The New Jersey Board of Public Utility Commissioners has granted the company permission to issue bonds for $20,000 for extensions.

Central Illinois Light Company, Peoria, Ill.—A block of first and refunding mortgage bonds is being offered at 97.5 and interest yielding 5.15 per cent.

Consolidated Gas, Electric Light & Power Company of Baltimore, Md.—An announcement has been made that plans for the retirement of 120 shares of the preferred stock of the company have been completed between three prominent banking houses and the company. The new arrangements call for more comprehensive financial plans than were first decided upon. The company now proposes to make an issue of $8,500,000 of 5 per cent five-year convertible gold notes and coincidentally to pay off all its $4,103,754 preferred stock at 120. The right is given, subject to approval by the Public Service Commission of Maryland, to the common shareholders of record Oct. 13, to subscribe on or before Nov. 15, 1916, for the notes to the extent of 60 per cent of their respective holdings of the common stock. The proceeds of the sale of these notes will be used for the retirement, by purchase or redemption, of the now outstanding preferred stock, and for the acquisition of property, the construction, completion, extension and improvement of its plant and distributing systems, and the discharge of its floating indebtedness heretofore incurred for these purposes. The notes will be dated Nov. 15, 1916, and will mature on No. 15, 1921. They will bear 5 per cent interest from Nov. 15, 1916, and will be convertible at the option of holders after Nov. 15, 1918, into common stock at $110 per share. The company reserves the right to call for redemption all or any part of the notes on any interest date on or after May 15, 1919, at 101.5 per cent of par and interest, on sixty days notice, but if so called for redemption the notes may be converted into common stock up to thirty days prior to the date of redemption. Notes will be in denominations of $100, $500 and $1,000. Upon the approval of this issue of notes by the Public Service Commission of Maryland the company will call for redemption on April 1, 1917, its now outstanding preferred stock.

Detroit (Mich.) Edison Company.—This company has officially taken over the Eastern Michigan Edison Company. The plant at Geddes is to be replaced by a new and modern plant.

Manistique (Mich.) Light & Power Company.—Reports from Manistique state the property of the company, together with that of the Consolidated Lumber Company, has been purchased by Minneapolis interests. It is understood that plans are held for the immediate enlargement of the power plant and operating facilities.

Mount Whitney Power & Electric Company, Visalia, Cal.—On Sept. 5 the control of the company passed from John Hays Hammond to H. E. Huntington and associates of New York, and at a directors' meeting held on that day the following officers were elected: President, G. C. Ward; treasurer A. N. Kemp; vice-presidents, Ben M. Maddox, S. Mitchell and W. R. Spalding; directors, C. R. Blyth and E. R. Davis. Fred G. Hamilton is to be superintendent of the Western division and A. J. Robertson of the Eastern division. R. E. Smith will be in charge of the sales department, E. E. Baker is secretary and R. C. Bulger, auditor. The new owners plan an energetic business campaign for the development of this company's territory.

Sheboygan (Wis.) Electric Light & Power Company.—A new issue of $225,000 of first mortgage 6 per cent sinking fund gold bonds due on Aug. 1, 1913, is being offered at par and interest. It is planned to use part of the proceeds of this issue to largely increase the development on the Black River, where the company now operates two hydroelectric plants.

West Texas Electric Company, Sweetwater, Tex.—The company will enlarge its electric light and power plant. It has just increased its capital stock from $300,000 to $500,000.

The Wichita (Tex.) Falls Electric Company.—The company has increased its capital stock from $700,000 to $775,000. It will make improvements to its plant.

New Utility and Industrial Companies

The Automatic Electric Generating System Corporation of New York, N. Y., has filed articles of incorporation with a capital stock of $100,000 by M. Elson, F. Samuels and M. Giles, 149 Broadway, New York, N. Y.

The Farm Lighting & Power Company of Paterson, N. J., has been incorporated by Edwin Karz, Carl Katz of Paterson and F. A. Meade of Bayonne, N. J. The company is capitalized at $10,000 and proposes to deal in gas, oil and electric machinery for lighting, heating and power.

The Rathbone Sard Electric Company of Albany, N. Y., has been incorporated by R. E. Sard, H. P. G. Nostrand and H. M. Blanchard, North Ferry Street, Albany, N. Y. The company is capitalized at $50,000 and proposes to manufacture and deal in electric stoves, ranges, bake ovens, cooking utensils, etc.

The Coleman Leasing Corporation has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,000,000. The company proposes to manufacture, sell, lease and operate and deal in and with illuminating signboards. The incorporators are: Samuel B. Howard, S. Anderson and L. H. Gunther, all of New York, N. Y.

Trade Publications

Lighting Fixtures.—The Alter Light Company, 430 South Green Street, Chicago, Ill., has issued an illustrated leaflet on lighting fixtures.

Lighting Fixtures.—The Gleason-Tiebout Glass Company, 200 Fifth Avenue, New York City, has issued "Celestialite," a four-page leaflet on some of its recent installations.

Portable Hoists.—"Reliable Erie" Portable Hoists is the title of an illustrated catalog and price list prepared by the Erie Clutch & Pulley Company, 2018 Holland Street, Erie, Pa.

Fixture Sockets.—The Wirt Company, Germantown, Philadelphia, Pa., has prepared a circular for dealers announcing its coming advertising campaign. The circular is well illustrated.

Electric Iron.—A circular issued by the American Electrical Heater Company of Detroit, Mich., shows a sectional view of the "American Beauty" electric iron, emphasis being given to exclusive features.

Receiver Separators.—"Welderon Receiver Separators" is the title of Bulletin F issued recently by the Elliott Company of Pittsburgh, Pa. The text is well illustrated and various types of separators are described.

Economizers.—The B. F. Sturtevant Company, Hyde Park, Boston, Mass., has prepared Bulletin No. 222 on economizers in the power plants of paper mills. This twenty-page text is well prepared, giving illustrations of many installations of the economizers.

Oil Engine.—The De La Vergne Machine Company, foot of East 138th Street, New York City, has recently issued Bulletin No. 158 on its Type "D H" oil engine. The text consists of sixteen well illustrated pages describing each important part of the engine.

Multivane Fans.—"Multivane Volume Fans" is the subject of Bulletin 228 recently prepared by the B. F. Sturtevant Company, Hyde Park, Boston, Mass. This well prepared bulletin brings out advance information, dimensions, capacities, horsepowers, etc., of the design No. 3 multivane fans.

Heaters.—Catalog No. 230, just issued by the B. F. Sturtevant Company, Hyde Park, Boston, Mass., has been designed to suit the needs of all classes interested in heaters and heating. The first part of the book describes the operation, construction and mechanical details of Sturtevant heaters, and is intended for those who are not buying this class of apparatus regularly. The latter part, which gives performance tables, diagrams and dimensions, is for the benefit of engineers, architects and steamfitters, and will enable them to choose the heater necessary for any given building. Diagrams showing proper methods of making steam connections and the space occupied by heaters are also included. The text is carefully got up and well illustrated.

New England

BROCKTON, MASS.—The contract for the installation of a new electric-lighting system at the Normal School building, a system of telephones between all buildings and a renewal of the clock system and call systems in the school building has been awarded to the Tremaine Electric Company of Brockton at $10,995.

LUNENBURG, MASS.—Plans are being considered for extension of the municipal electric-lighting system to Goodrichville, Mulpus and Flat Hill. A. A. Coop is commissioner.

WEBSTER, MASS.—Preparations are being made by the Webster & Southbridge Gas & Electric Company of Webster for the erection of high-tension wires to connect the Southbridge and Oxford lines. This line, which is intended to increase the supply of the Charlton City mills, will pass through Charlton Center, over Muggett Hill and through Putnamville to the Oxford line.

WORCESTER, MASS.—The City Council has authorized an extension of the new luminous arc-lighting system on Cambridge for a distance of about half a mile.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Company is planning to build an addition to its power plant (48 ft. by 70 ft.) on Elm Street. Other improvements and extensions are also contemplated.

NEW LONDON, CONN.—Arrangements are being made to eliminate overhead wires on State Street. Wires for maintaining the ornamental lighting system will be placed in conduits and others transferred to rear of buildings.

Middle Atlantic

BROOKLYN, N. Y.—Bids will be received by the New York Municipal Railway Corporation, 85 Clinton Street, Brooklyn, until Oct. 16 for installation of tunnel and station lighting equipment, etc., Broadway subway, Manhattan. Plans and further information may be obtained upon application to chief engineer, 85 Clinton Street, Brooklyn.

DUNKIRK, N. Y.—The grant of a restricted franchise to the Niagara & Lake Erie Power Company of Buffalo to supply energy in Dunkirk for industrial purposes was approved at a special election held recently. The franchise permits the company to supply service to consumers using 75 hp. or more.

EDEN, N. Y.—The Niagara & Lake Erie Power Company of Fredonia has petitioned the Public Service Commission for authority to erect an electric transmission line to the town of Eden and install a distribution system here.

MIDDLETOWN, N. Y.—Plans are being considered by the Council for the installation of a new lighting system on North Street, to be installed by the Orange County Lighting Company.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, until Oct. 9 for installing electric equipment in additions to and alterations in Public School 45 on East 189th Street, Lorillard Place and Hoffman Street, borough of the Bronx.

NEW YORK, N. Y.—Bids will be received by the Interborough Rapid Transit Company at the office of George H. Pegram, chief engineer, 165 Broadway, New York City, until Oct. 16 for completion of the passenger station electric-lighting and electric-heating systems for portions of a rapid transit railroad in the borough of Queens, routes 36 and 37, and the Jerome Avenue and White Plains Road lines in the borough of the Bronx, routes 16 and 18. Specifications, form of contract, etc., may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Fifty-ninth Street and Park Avenue, New York, until Oct. 16 for tool equipment (and electric wiring for same), duplicate school plan, in Public Schools 50, 72, 110, 125, 126, 149, 150, 156 and 165, borough of Brooklyn; also Public Schools 109 and 171, borough of Manhattan, and Public School 6, borough of Queens. Separate bids to be submitted on each item. Blank forms, plans and specifications may be seen or obtained at the above office.

ONEONTA, N. Y.—The Ithaca Gas & Electric Company has applied to the Public Service Commission for permission to purchase the capital stock of the Oneonta Light & Power Company, aggregating $227,800.

PORT HENRY, N. Y.—The capital stock of the Port Henry Light, Heat & Power Company has been increased from $50,000 to $100,000. The company contemplates improvements to its system.

POTSDAM, N. Y.—Bids will be received by Dr. Thomas E. Finegan, deputy commissioner of education, Educational Building, Albany, until Oct. 31 for construction, heating, plumbing and drainage and electric work for the reconstruction of the State Normal and Training School at Potsdam. Plans and specifications may be obtained upon application to Lewis F. Pilcher, state architect, Capitol, Albany, upon deposit of $10.

ERIE, PA.—Plans are being prepared for the construction of a new substation for the Erie Lighting Company. Day & Zimmerman of Philadelphia, Pa., are architects.

ERIE, PA.—Plans are being prepared by the Hammermill Paper Company for the construction of a new power plant, three stories, 88 ft. by 116 ft., to cost about $50,000. The Osborn Engineering Company, Engineers Building, Cleveland, Ohio, is consulting engineer.

MOUNT CARMEL, PA.—The Edison Electric Illuminating Company is erecting a three-phase, 60-cycle, 22,000-volt transmission line to furnish 1200 hp. to the Colonial Collieries Company at Natalie. Line material and transformers have been purchased. S. S. Watkins is manager.

PHILADELPHIA, PA.—Work will soon be begun on a power station by the Philadelphia Electric Company at South Chester. The plant will be built in the form of two units, and will have a total capacity of 120,000 kw. The first unit will be ready for operation in September, 1917, and will be operated by the Beacon Light Company, a subsidiary of the Philadelphia Electric Company.

PITTSBURGH, PA.—John J. McKelvey, director of Public charities, has asked the City Council for an appropriation for the installation of an electric-lighting system at the City Home at Mayview.

POLK, PA.—Bids, it is reported, will be received by the State Board of Public Grounds and Buildings, Harrisburg, until Oct. 17 for the installation of a new turbine generator unit in the power plant at the Polk Institute at Polk.

STEELTON, PA.—Plans are being considered by the City Council for the elimination of overhead wires in the business district. Standards will be erected for arc lamps.

TAMAQUA, PA.—The Public Service Commission has approved contract for the installation of a street-lighting system in Tamaqua by the Eastern Pennsylvania Light, Heat & Power Company of Pottsville.

UNION CITY, PA.—The Public Service Commission has given its approval of a contract for the installation of a street-lighting system in Union City by the Union City Electric Company.

BELLEVILLE, N. J.—The Kent Motors Company, recently incorporated, is planning to build an electric power plant in connection with its proposed manufacturing plant in Hillside section. Marvin & Davis, 303 Fifth Avenue, New York, N. Y., are architects.

BOONTON, N. J.—The Boonton Electric Company has been granted permission by the Board of Public Utility Commissioners to issue $20,000 in bonds, the proceeds to be used for extensions.

ELIZABETH, N. J.—The Public Service Electric Railway Company has been granted permission by the Board of Works to lay underground conduits, manholes and service pipes in Bayway.

IRVINGTON, N. J.—The Town Commission is considering the installation of 600-cp. nitrogen street lamps on Union Place, Harper Avenue and other streets.

NEWARK, N. J.—The construction of a new power house on Bank Street for the German Hospital is under consideration.

NEWTON, N. J.—An appropriation of $8,000 for the installation of an electric-lighting system, to replace the gas system recently installed, is under consideration by the town committee.

NEW BRUNSWICK, N. J.—The Public Service Company is contemplating placing its wires underground throughout the city. The cost is estimated at $100,000.

RIDGEWOOD, N. J.—Bids will be received by the board of education of Ridgewood, until Oct. 30, for the construction of a new high school building. Separate bids to be submitted for electrical work, heating and ventilating. H. S. Willard is president of the board.

BALTIMORE, MD.—The proposal to appropriate $1,000,000 to continue the construction of the municipal conduit and electrical subway system will be submitted to the voters on Nov. 7. Raleigh C. Thomas is chief engineer of the electrical subway commission.

COLONIAL BEACH, VA.—D. J. Gatchell, 3614 Park Place, Washington, D. C., would like catalogs, prices, etc., on electric-light plant for hotel at Colonial Beach, Va.

RICHMOND, VA.—Bids will be received at the office of the Administrative Board, 305 City Hall, Richmond, Va., until Oct. 11 for furnishing one electrically-driven centrifugal pump of 5,000,000-gal. capacity for water boosting service, and also one 150-hp. alternating-current induction type, three-phase, wound rotor motor for operation on a 60-cycle, 3600-volt circuit. Specifications may be obtained upon application to Room 417 City Hall, Richmond. E. W. Trafford is city electrician.

ROANOKE, VA.—Extensive improvements, involving an expenditure of between two and three million dollars, will be made by the Norfolk & Western Railway Company within the next few months. Among the improvements planned is the extension of the electrification of its system on three divisions, a new freight station and additions to its shops in Roanoke, etc.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 1 for the installation of an electrically-operated sidewalk type mail lift, new hoistway, etc., in the United States post office, court house and custom house in Miami, Fla. For details see proposal columns.

WASHINGTON, D. C.—Among the recommendations submitted to the Commissioners of the District of Columbia by the Columbia Heights Citizens' Association is the installation of an electric-lighting system on Fourteenth Street, from Florida Avenue to Shepherd Street northwest, and the installation of electric lamps on a number of other streets in that section of the city.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Oct. 13 for furnishing under proposal 853, 100 receivers, 50 ringers, 100 screw plugs, 100 caps, 100 rings, 50 slides, 25 generators, 250 plugs, 200 cups, 450 condensers, 500 diaphragms, 10,000 carbide charges, 27 generators, 104 receivers, 104 transmitters, 136 cross connecting blocks, hand set telephones, telephone head set, retardation coils, mountings for same, gun telephones and condensers. For further information address Charles S. Wallace, major, signal corps, U. S. A.

WASHINGTON, D. C.—The special board of engineer officers, composed of Col. H. C. Newcomer, Lieut.-Col. C. A. F. Flagler and Lieut.-Col. William W. Harts, has submitted a report to the Secretary of War indorsing the project of the Langfitt Board of 1913 for the establishment of a power plant near the Great Falls of the Potomac for the dual purpose of increasing the water supply of the District of Columbia and for development of power to generate electricity for lighting and other purposes for the Federal and District Governments. The Langfitt plan contemplates the construction of a dam in the river about a third of a mile above Chain Bridge. The cost is estimated at $5,172,600 for increase of water supply and $9,849,000 for power development.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations the following supplies: Puget Sound, Wash., Schedule 211—for furnishing and installing electrically-operated refrigerating apparatus. Charleston, S. C., Schedule 216—one feed water heater, one fuel oil heater, one turbine-driven blower, one engine ash hoist, two ice machines, one ton capacity, one oil-fuel hand pump; Schedule 205—one combined air circulating pump, two main and auxiliary feed pumps, one main air pump, two fuel oil service pumps. Newport, R. I., Schedule 213—1200 lb. ¾-in seamless brass pipe, 3200 ¾-in. brass socket pipe plugs; Schedule 197—100 electric soldering irons; Schedule 203—300 lb. clear uncut mica, 40,000 ft. ebonite tubing, 15,000 ft. iridium platinum wire. Brooklyn, Mare Island, Schedule 194—eight turbine-driven blowers. Portsmouth, N. H., Schedule 198—one electric blue-printing machine. Brooklyn, N. Y., Schedule 206—miscellaneous laundry machinery; Schedule 210—1250

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

caps, complete with pivot and chain assembled, 40 mangin and parabolic searchlight mirrors. Washington, D. C., Schedule 214—Four hydraulic power pumps; Schedule 210—miscellaneous outlet and junction boxes, 225 conduiets ells, 10,350 lock nuts for conduits, 500 lb. wire solder. Boston, Mass., Schedule 204—7850 lb. soft sheet copper not tinned; Schedule 210—255 lb. hard sheet rubber. Various, Schedule 210—miscellaneous annunciators, miscellaneous vibrating bells and buzzers, steel and brass conduit, miscellaneous sheet and rod fiber, electric flatirons, refillable inclosed fuses, glass tube fuses, 11,500 n.w.t. portable guards, electric soldering irons, uncut mica, linen finished muslin, attachment plugs, miscellaneous portable ventilating sets, switches, magnet wire. Boston, Philadelphia, Schedule 210—miscellaneous push buttons. Norfolk, Va., Schedule 210—25 w.t. firing salvo buzzers, miscellaneous resistance wire. Mare Island, Cal., Schedule 210—plate carbon. Annapolis, Md., Schedule 199—one dynamometer. Boston, Norfolk, Schedule 210—miscellaneous link fuses, miscellaneous fusewire. Philadelphia, Norfolk, Schedule 210—miscellaneous plug fuses. Brooklyn, Philadelphia, Schedule 210—miscellaneous testing generators. Philadelphia, Pa., Schedule 210—30 disk type electric heaters, eight sets 36-in. searchlight strips. Boston, Washington, D. C., Schedule 210—600 rolls (36-yard rolls) white muslin tape. Applications for proposals should designate the schedule desired by number.

North Central

DETROIT, MICH.—The directors of the Michigan State Telephone Company have approved an appropriation of $1,000,000 for the erection of two new exchanges, additions to present buildings and cable extensions.

DETROIT, MICH.—Contracts have been awarded by the Board of Education for electrical work for school buildings in the city as follows: For the Bishop School annex to the McCleary-Harmon Company; the Lincoln School to the John Miller Electrical Company, and for the McGraw-Pittsburg School to the John Miller Electrical Company, all of Detroit.

FLINT, MICH.—Bids will be received by A. J. Wildanger, secretary of school board, Flint, Mich., until Oct. 12, for construction of the Dort School Building, separate bids to be submitted as follows: (1) Heating and ventilating; (2) plumbing; (3) electric wiring; (4) general work, including all work and materials not included in other proposals. Or in one proposal covering the entire building. Plans and specifications may be obtained upon application to Malcomson & Higginbotham, architects, 404 Moffatt Building, Detroit, upon deposit of $10.

MANISTIQUE, MICH.—Francis W. Little and associates of Minneapolis have purchased the plant and water power rights of the Manistique Power & Light Company, including about 1000 hp. of undeveloped water power, and water power rights of the Consolidated Lumber Company, amounting to nearly 4000 hp. of undeveloped water power, including the Bronson mill property and the Indian River dam. The new owners propose to build a modern paper mill on the site of the Bronson Mill, to cost approximately $1,000,000; a large pulp mill of 6000 tons capacity and improvements to the electric-light and power system. The cost of the entire work is estimated at $1,500,000. Work will begin at once on the reconstruction of the dam and new pulp mill.

MILFORD, MICH.—Preparations are being made for the erection of an engine room at the works of the Detroit Auto-Dash Company to house a new steam power plant. The company is considering doubling the capacity of its manufacturing plant.

PORT HURON, MICH.—Application has been made to the City Council by the Detroit (Mich.) Edison Company for permission to erect transmisson lines on several streets in the city to connect with a substation which the company proposes to build on Miltary Street. Plans are also being prepared by the company for the construction of a substation at Bunce Creek next year.

AKRON, OHIO—The City Council has passed an ordinance providing for lighting West Market Street from the west line of the Ohio Canal to Maple Street with electricity.

BELLEVUE, OHIO—The installation of a municipal electric-light plant is reported to be under consideration by local business men.

FREMONT, OHIO—Right of way has been obtained by the Ohio Light & Power Company for the erection of a high-tension line between Fostoria and Fremont. The line will be erected on steel towers.

GLOUSTER, OHIO—The Council is considering the purchase of energy to operate the municipal electric-lighting system from the Hocking Power Company of Nelsonville.

MIDDLETOWN, OHIO—The Colin-Gardner Paper Company is contemplating enlarging its power plant.

OXFORD, OHIO—The proposition to rehabilitate the municipal electric-light plant or to contract for special service from the Richmond municipal plant will be submitted to the voters.

SEBRING, OHIO—An option has been taken by Theodore Munroe of Lisbon, representing the Ohio Gas & Electric Company, on the local electric-lighting system. If the company takes over the plant it will be enlarged and the lines will be extended to Quaker Hill, a suburb. It is also proposed to erect transmission lines to Beloit and Damascas to the east and Atwater and Limaville, north of Alliance.

ZANESVILLE, OHIO—Steps have been taken by property owners on Fifth Street to secure an ornamental lighting system.

LANCASTER, KY.—The installation of an electric-light and power plant is under consideration by Bastin Brothers, who were recently granted a franchise in Lancaster.

PAINTSVILLE, KY.—Steps have been taken toward the establishment of a light and water plant in Paintsville. John Buckingham is reported interested.

CHARLESTOWN, IND.—Preparations are being made by the Louisville & Northern Railway & Lighting Company for the installation of a new street-lighting system in Charlestown. The company has abandoned the plan to erect a transmission line from Louisville, owing to the high price of copper.

CROWN POINT, IND.—The Interstate Public Service Company is contemplating enlarging its local plant.

WARSAW, IND.—The City Council is considering the installation of a new street-lighting system in the business district.

DUNNING, ILL.—Bids will be received by the Board of Administration, Springfield, Ill., until Oct. 10, for furnishing and installing main switchboard, generator and exciter, wiring connections, transformers, etc., and accessories in the power house at the Chicago State Hospital, at Dunning. Plans and specifications may be obtained on application to Martin C. Schwab, consulting engineer, Mallers Building, Chicago, Ill.

DUNNING, ILL.—Bids will be received by the Board of Administration, Capitol Building, Springfield, Ill., until Oct. 17 for construction of a kitchen, bakery and dining room building at the Chicago State Hospital, Dunning. Separate bids will be received on general work, heating, plumbing and electric wiring. The bids are in lieu of bids received Aug. 15, which were rejected. Plans and specifications may be obtained at the office of James B. Dibelka, state architect, 130 North Fifth Avenue, Chicago.

FAIRBURY, ILL.—The local plant of the Central Illinois Utilities Company of Peoria was destroyed by fire on Sept. 27, causing a loss of from $8,000 to $10,000. Most of the energy to operate the system in Fairbury is obtained from the main plant at Watseka, the local plant being used in emergencies.

FREEPORT, ILL.—The installation of a new street-lighting system is under consideration. It is proposed to erect about 76 combination ornamental lamps and trolley posts, each carrying one 400-cp. Mazda lamp.

FREEPORT, ILL.—The Raleigh Manufacturing Company of Freeport is contemplating the construction of several factory buildings, to cost with equipment about $500,000. The plant will be equipped throughout with electrically operated machinery. The company will probably install its own electric generating plant. C. F. Fields is secretary.

GERMANTOWN, ILL.—Plans are being prepared for the construction of a municipal electric-light plant in Germantown. Bids, it is understood, will soon be asked. V. J. Kluthe, 915 Olive Street, St. Louis, Mo., is architect.

HANOVER, ILL.—A franchise has been granted to the Interstate Light & Power Company of Galena to furnish electrical service here.

HARDIN, ILL.—Work has begun on the construction of a new electric light plant in Hardin, to cost about $6,000.

MONTGOMERY, ILL.—The Montgomery Hydroelectric Company has applied to the Public Utilities Commission for permission to construct and operate a hydroelectric plant in Montgomery.

ROCKFORD, ILL.—The report submitted to the City Council by Dabney H. Maury of Chicago, consulting engineer, and the waterworks committee, recommends the city to construct and operate a municipal light and power system. The cost of the plant and equipment is estimated at $425,000.

SPRINGFIELD, ILL.—The City Commission has decided to submit to the voters the proposal to purchase an auxiliary generator for the municipal electric plant on Nov. 7.

STREATOR, ILL.—The Public Service Company of Northern Illinois, it is reported, contemplates extensions and improvements to its local plant soon.

ALMA, WIS.—The Wisconsin-Minnesota Light & Power Company of Eau Claire contemplates the extension of its transmission lines through this section of the country to supply electricity for lamps and motors.

CLYMAN, WIS.—The Wisconsin Gas & Electric Company of Kenosha is considering extending its transmission line to Clyman.

MILWAUKEE, WIS.—The Universal Concrete Products Company has been awarded the contract for standards, at $106,850, and brackets, at $7,225, for additions to the municipal street-lighting system. Fred G. Simmons is commissoner of public works.

MILWAUKEE, WIS.—The Milwaukee Light, Heat & Traction Company has submitted a proposal to the City Council offering to supply energy for flushing of the Milwaukee River by the pumps at the yacht club flushing station, at $9,000 per year. F. G. Simmons, commissioner of public works, states that in his opinion the river cannot be flushed with such power as can be furnished by the auxiliary steam plant at the Erie Street incinerator.

WAUPACA, WIS.—The property of the Waupaca Electric Light & Railway Company has been purchased by E .A. Aspness of Montevideo and Truman Hibbard of Minneapolis. The new owners will take possession Nov. 1.

BLOOMING PRAIRIE, MINN.—Improvements are contemplated by the L. G. Campbell Manufacturing Company, including the installation of a new high-pressure boiler and a compound condensing engine.

COLOGNE, MINN.—The Waconia (Minn.) Light & Power Company will install a street-lighting system in Cologne, consisting of about 20 lamps of 70 and 100 cp. E. F. Strong of Waconia is president and manager of the company.

GARY, MINN.—The Village Council has granted J. F. Heiberg of Heiberg a franchise to install and operate an electric distributing system in Gary.

GOODRIDGE, MINN.—A franchise has been granted by the Village Council for an electric-lighting system, to be installed this fall.

GOOD THUNDER, MINN.—The Good Thunder Electric Company is in the market for 3000 lb. No. 6 bare copper wire, 1000 ft. No. 4 standard wire, three Gartner Daniels lightning arresters, one pole type fuse switch for 13,200 volts, 300 insulators for 13,200 working test. F. H. Griffin is secretary.

GRANADA, MINN.—The installation of an electric-lighting system in Granada is under consideration.

KELLIHER, MINN.—The purchase of a new feed water heater for the municipal electric-light plant is under consideration. J. A. Wilson is superintendent.

MAZEPPA, MINN.—Bonds to the amount of $8,000 have been voted for the installation of an electric-lighting system in Mazeppa.

NEW PRAGUE, MINN.—The Board of Electric Light Commissioners contemplates the construction of a concrete or brick chimney 40 ft. by 100 ft. at the municipal electric light plant and the erection of new lines; also the purchase of about twenty 220-volt, two-wire, direct-current meters. Joseph T. Rynda is superintendent.

PINE CITY, MINN.—Preparations are being made by the Eastern Minnesota Power Company to extend its transmission line from Isanti to Bethel to supply electricity in the latter village.

WASECA, MINN.—The Waseca Water and Light Board is contemplating the installation of a new pump in water-works station, either a motor-driven triplex pump or centrifugal pump will be used. The board would like to receive prices and other information on the above equipment. F. B. Fowle is superintendent.

GRINNELL, IOWA—Preparations are being made by the Iowa Light, Heat & Power Company for the construction of a new power house in Grinnell for which bids have been received. Frederick Putnam Platt, 1123 Broadway, New York, N. Y., is architect.

FARMINGTON, MO.—The city of Farmington expects to purchase soon a new deep well pump and also a boiler feed pump for the municipal electric-light and water plant. C. M. Thomson is superintendent.

IBERIA, MO.—The electric light company expects to purchase nitrogen lamps and wire. John Musick is owner and manager.

MARCELINE, MO.—Improvements are contemplated to the municipal electric-light plant, including the installation of a 300-kw. generator, a 450-hp. engine, one 14-kw. exciter, two panels for switchboard and the erection of 1½ miles of new transmission line. H. A. Spalding is superintendent.

OZARK, MO.—The Water Power Light Company of Ozark contemplates changing its entire system, including transformers, meters, motors and domestic appliances from 60 to 25 cycles. O. L. McBride is receiver.

PIERCE CITY, MO.—The Ozark Power & Water Company of Branson is erecting a high-tension transmission line from a substation near Monett to a substation being erected in Pierce City. The company has recently secured a contract to supply energy for lighting and power purposes in Pierce City. The cost of the equipment for the Pierce City substation is estimated at about $40,000. The company has recently purchased the municipal plant in this city.

STE. GENEVIEVE, MO.—The Home Light & Water Company is planning to erect 2 miles of transmission line, material for which has already been purchased. Guy E. Paxton is superintendent.

MEDINA, N. D.—The installation of an electric-light plant in Medina is under consideration. E. P. Olson is reported interested.

GARRETSON, S. D.—Bids will be received by the town of Garretson until Oct. 10, for one or more internal combustion fuel oil engines, aggregating a total of 125 hp., together with alternating-current generators, switchboard, building, cooling tower, line material and transformers. Bids will also be entertained on both belted and directly connected units. Plans and specifications are on file at the office of the city auditor and at the office of the Electrical Development Company, engineers, Omaha, Neb.

CEDAR BLUFFS, NEB.—The purchase of poles and meters for the municipal electric-light system is under consideration. L. J. Schere is superintendent.

IMPERIAL, NEB.—Preparations are being made for the construction of a municipal electric-light plant in Imperial for which bids have been received. The cost of the plant is estimated at $28,000 and includes dam, power house, distribution system and waterworks. Grant & Fulton, Bankers Life Building, Lincoln, Neb., are engineers.

WOLBACH, NEB.—Plans are being prepared by the Martz Engineering Company, Orpheum Building, Lincoln, for the construction of a power plant and distribution, to cost about $10,000, in Wolbach.

BONNER SPRINGS, KAN.—The Public Utilities Commission has granted the Bonner Springs Gas & Electric Company permission to issue $30,000 in bonds of which the proceeds of $20,000 will be used to purchase the property of the company, recently organized by Elmer Strain of Topeka. The remaining $10,000 to be used for extensions and improvements.

HURON, KAN.—Bonds have been authorized for the installation of an electric-lighting system in Huron. A transmission line will probably be extended from Atchison to supply energy to maintain the system.

MORAN, KAN.—Bonds to the amount of $12,000 have been voted for the installation of a municipal electric-light plant and waterworks system. W. B. Rollins & Co., Railway Exchange Building, Kansas City, Mo., are engineers.

Southern States

HICKORY, N. C.—The city of Hickory has granted the Southern Public Utilities Company of Charlotte a franchise to furnish electricity. Under the terms of the new franchise the company will install an ornamental street-lighting system.

SALISBURY, N. C.—The Southern Bell Telephone & Telegraph Company contemplates the construction of a new exchange building and placing its wires underground in Salisbury. The cost is estimated at about $125,000.

HOWEY (Not a Post Office), FLA.—The Howey Land Company, it is reported, contemplates the installation of an electric-light plant and pumping station. J. H. Kelley, 76 West Monroe Street, Chicago, Ill., is general manager, and Fred J. Postel, 343 South Dearborn Street, Chicago, Ill., is engineer.

SOUTH JACKSONVILLE, FLA.—Bids will be received by the Board of Bond Trustees, South Jacksonville, until Oct. 18 for furnishing a unaflow type engine for direct connection to a 175-kva. generator for the municipal electric-light and water plant. E. C. Broward is chairman of board.

VERO, FLA.—The installation of an electric-light plant and ice factory in Vero is under consideration. N. J. Norman of St. George, Ga., is reported interested.

BEARDEN, TENN.—The Colonial Lumber Company of Bearden would like estimates on an electric plant (new or second-hand) for lighting a small town.

ERWIN, TENN.—The Crystal Ice & Coal Company of Erwin, recently organized with a capital stock of $25,000, contemplates the erection of a brick building, 40 ft. by 100 ft., for ice plant, daily capacity 15 tons. The company would also like prices on electrical equipment. W. W. Remine is vice-president and manager.

BLACKWELL, OKLA.—At an election to be held Oct. 12 the proposal to issue $35,000 in bonds for improvements to the municipal electric-light plant and waterworks system will be submitted to the voters.

BUFFALO, OKLA.—An election will be held Oct. 11 to submit to the voters the proposal to issue $15,000 in bonds for the installation of an electric-lighting system and $15,000 for waterworks.

DUNCAN, OKLA.—The city of Duncan, it is reported, is asking for bids for the installation of a street-lighting system. Bonds have been authorized ($5,000) for the purchase of poles, generators, etc. Engines have been purchased.

MUSKOGEE, OKLA.—Plans have been approved by the Missouri, Kansas & Texas Railway Company for the erection of new shops in Muskogee, involving an expenditure of about $200,000. Electric power requirements will be served by the Muskogee Gas & Electric Company.

WOODWARD, OKLA.—The contract for wire and machinery for the municipal electric plant has been awarded to the Western Electric Company.

ATLANTA, TEX.—The Atlanta Electric & Ice Company, it is reported, will rebuild its electric plant, which was recently destroyed by fire. The cost of the new plant is estimated at $40,000.

AUSTIN, TEX.—The City Council has authorized the purchase of a 2000-kw. generator and turbine from the General Electric Company, to cost $25,330, and a condenser and appurtenances from the Henry Worthington to cost $13,070, for the municipal water-works and electric-light plant.

BELLEVILLE, TEX.—The Belleville Ice, Light & Power Company, recently organized with a capital stock of $30,000, has purchased the property of the Belleville Promoting Company, consisting of an electric-light plant and ice factory.

PARIS, TEX.—The contract for electrical work for the Lamar County court house has been awarded to R. M. Johnson & Co. of Dallas, at $4,180.

Pacific States

OLYMPIA, WASH.—The State Land Commission has granted a petition for an extension of time on the power project of Hugh L. Cooper on the Pend Oreille River, in the event that Congress fails to pass the Federal legislation necessary to put the project through within the limit allowed by the State.

RITZVILLE, WASH.—The Washington Water Power Company of Spokane contemplates improvements to the local lighting system, including the increasing of the number of street lamps from 59 to 80; also the erection of new poles on Second Street.

SEATTLE, WASH.—Three water power rights have been filed by G. M. U. Tait, 4711 Eighth Avenue Northeast, Seattle, permitting him to divert 15,000 cu. ft. of water per second from three different places on the Skagit River. The filings indicate the construction of a power plant about 16 miles above Marblemount on Skagit River.

SOUTH CLE ELUM, WASH.—Bonds to the amount of $5,000 have been voted for the installation of an electric-lighting system in South Cle Elum. Connection will be made with the transmission lines of the Northwestern Improvement Company in Cle Elum.

BANDON, ORE.—The Oregon Power Company of Eugene is reported to be negotiating for the purchase of the plant of the Bandon Power & Light Company.

EUGENE, ORE.—The extension of the municipal lighting and power lines down the river road as far as the village of Santa Clare, to supply electricity to farmers in that vicinity is under consideration by the Eugene Water Board. G. W. Geller is superintendent.

BERKELEY, CAL.—The contract for additions to power plant of the University of California has been awarded to C. C. Moore & Co. of San Francisco, at $49,589. The F. E. Newbery Electric Company of San Francisco was awarded the contract for electric work for the first unit of the Chemistry Building.

MERCED, CAL.—The establishment of an electrolier district, embracing all of the business section and part of the residence streets of the city, has been announced by the City Trustees. It is proposed to light this district with electroliers. The initial installation will include 60 lamps.

NORTH SACRAMENTO, CAL.—The installation of a street-lighting system in North Sacramento is under consideration.

VISALIA, CAL.—The City Trustees have appointed a committee to make investigations regarding the installation of an electrolier lighting system on several streets of the city; also for lighting Hyde Park.

MURRAY, IDAHO.—An auxiliary steam plant, it is reported, will be installed at the Paragon mine, near Murray. L. W. Stedman is manager of the mine.

PRESCOTT, ARIZ.—The Arizona Hydraulic Power Company of Prescott contemplates the construction of a diversion dam on Verde River, 23 miles south of Campe Verde, and a hydroelectric development, consisting of three generating units having a total output of 6500 hp.; the erection of a transmission line, 120 miles long, and construction of 12 miles of ditches and flumes to convey water to power plants. E. Meeks of Prescott is manager.

MALTA, MONT.—At an election held recently the proposal to grant the Standard Electrical Engineering Company a 20-year franchise to install and operate an electric and steam heating plant was carried. The company proposes to install an electric lighting and steam heating plant and agrees to furnish a 24-hour electric service and to furnish steam heat to the city buildings in exchange for the franchise.

RENO, NEV.—Plans for the development and equipment of the Goodwin-Plumas mine in Galena Cavern, 12 miles from Battle Mountain, providing for the construction of a power generating plant and a 3-ton mill have been announced by the Nicklas Mining Company. It is proposed to install a plant of from 500 to 800 hp., using fuel oil for generating purposes. Work on the project will begin in the spring.

Canada

WINNIPEG, MAN.—The erection of an electric transmission line from the municipal electric power plant at Point due Bois to the Rice Lake gold fields, a distance of between 50 and 60 miles, is under consideration by the Board of Control.

DUNNVILLE, ONT.—The by-laws providing for the installation of hydroelectric power and the purchase of the local electric power plant have been approved by the ratepayers.

LONDON, ONT.—The city of London Hydro-Electric Commission is considering the installation of a water wheel, electric generator and a 250-hp. pump for waterworks, to cost about $15,000. E. V. Buchanan is general manager.

MONTREAL, QUE.—The Board of Control has recommended to the City Council that $45,000 be appropriated in connection with the appointment of a consulting engineer for the new hydroelectric pumping plant of the aqueduct and the preparation of plans, etc.

Miscellaneous

PANAMA—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Oct. 30, for furnishing equipment for hydroelectric station, including penstocks, water turbine-driven exciter, power transformers, induction motor-driven pumps and traveling crane under circular (No. 1085). Bids will also be received until Oct. 19 for furnishing under circular (No. 1086) for steel, planished iron, drill rods, vanadium-steel tires, bolster guides, steel cable, electric cable, motor-driven centrifugal pumps, switchboard, water level indicator, etc. Blanks and general information relating to the above circulars may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, Arthur Kneisel, 29 South LaSalle St., Chicago, Ill.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Permanent Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York. Annual Convention, Atlantic City, N. J., Oct. 9-13.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

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ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago.

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CANADIAN ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary-treasurer, Alan Sullivan, Excelsior Life Building, Toronto, Can.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

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ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF PENNSYLVANIA. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, 626 Lloyd St,. Milwaukee, Wis.

ELECTRICAL DEALERS AND CONTRACTORS' ASSOCIATION OF ONTARIO. Secretary, E. A. Drury, 45 Murray St., Toronto, Can.

ELECTRICAL MANUFACTURER'S CLUB. Secretary. H. B. Crouse, Crouse-Hinds Co., Syracuse, N. Y.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Next meeting, Cleveland, Oct. 10-12.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, 34 Ellis St., San Francisco, Cal.

ELECTRIC POWER CLUB. Secretary, H. Roth, 1410 West Adams St., Chicago. Next meeting, Hot Springs, Va., Nov. 15-18.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Affiliated with the N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

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ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. L. Blumenthal, 179 West Washington St., Chicago, Ill.

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INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 111 Broadway, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION N. E. L. A. Secretary, W. H. Thomson, Jr., Des Moines, Iowa.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

JOVIAN ORDER. Jupiter (president), Thomas W. Wynne, Indianapolis, Ind.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo. Annual convention, Indianapolis, Ind., Oct. 18-20.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. A. Mercer, 108 West Eighth Ave., Topeka, Kan.

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NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 19th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y. Next meeting, New Orleans Oct. 10, 1917.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343

NATIONAL FIRE PROTECTION ASSOCIATION. Marquette Building, Chicago. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. E. Egan, Room 201, Union Pacific Building, Omaha, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass.

NEW ENGLAND SECTION, ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, L. L. Edgar, 39 Boylston St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual meeting, Pittsfield, Oct. 17-20.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer E. A. Thiele, Roswell, N. M.

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OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary-treasurer, J. W. Oberender, 502 Dekum Building, Portland, Ore.

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ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTH DAKOTA ELECTRIC LIGHT ASSOCIATION. Secretary, A. H. Savage, Dakota Light & Power Co., Flandreau, S. D.

SOUTHWESTERN SECTION N. E. L. A. Secretary-treasurer, George H. Wygant, Tampa, Fla.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, Eugene Ashe, Dallas, Tex.

TRI-STATE WATER & LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 Jackson Bldg., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

1,199,042. MANUFACTURE OF CRYSTALLIZED ABRASIVES; T. B. Allen, Toronto, Can. App. filed July 24, 1916. Fuses alumina in electric furnace, controls temperature and pours and cools.

1,199,046. AUTOMATIC RELAY FOR ELECTRIC REGULATORS; W. L. Bliss, Niagara Falls, N. Y. App. filed April 13, 1912. Carbon pile construction.

1,199,050. FIRE ALARMS; C. J. Cid, Quebec, Can. App. filed July 27, 1915. Portable so as to be placed in any desired spot.

1,199,086. INDUCTION TRANSFORMER; J. Laufer, Berlin, Germany. App. filed April 24, 1914. For generating phase-displaced currents.

1,199,092. ELECTRIC TRANSFORMER AND WELDING, SMELTING, AND LIKE APPARATUS; R. Mack, Neu-Tempelhof, near Berlin, Germany. App. filed Sept. 12, 1913. Efficient single-phase low-tension transformer.

1,199,097. ELECTRIC MOTOR ARMATURE WINDING AND METHOD OF APPLYING THE SAME; T. M. Mueller, Detroit, Mich. App. filed April 6, 1914. Active portions connected to each other by articulated fashioned section.

1,199,145. DEVICE FOR TESTING WORKING OF MAGNETOS, ETC.; C. S. Zink, Marshall, Mo. App. filed March 10, 1915. Observable spark gaps.

1,199,156. AUTOMATIC TELEPHONE TRUNKING SYSTEM; W. L. Campbell, La Grange, Ill. App. filed May 12, 1908. Selection of trunks between different exchanges is purely automatic.

1,199,158. CALL DISTRIBUTING TELEPHONE SYSTEM; H. P. Clausen, Mt. Vernon, N. Y. App. filed Feb. 9, 1915. Avoids use of relays, etc.

1,199,172. SWIVEL FOR ELECTRICAL CONDUCTORS; F. Garrison, St. Louis, Mo. App. filed Nov. 8, 1915. For telephone cords and the like.

1,199,176. HIGH POWER RADIO APPARATUS; P. J. Hackett, Seattle, Wash. App. filed Dec. 27, 1915. Improved arrangement of transmitting units.

1,199,180. SYSTEM FOR THE TRANSMISSION OF INTELLIGENCE; R. A. Heising, East Orange, N. J. App. filed Oct. 9, 1915. Mode amphitude of high-frequency wave in accordance with wave form of a low-frequency signal to be transmitted.

1,199,196. SOUND TRANSMITTING DEVICE; C. W. McGonigle, Seattle, Wash. App. filed Oct. 4, 1913. Amplified construction.

1,199,199. ELECTRICALLY CONTROLLED HOOD LOCK; H. L. Mason, Kansas City, Mo. App. filed Jan. 29, 1914. Locks hood to prevent access for the purpose of tampering with ignition.

1,199,210. ELECTRIC LIGHTING SYSTEM FOR AUTOMOBILES; H. W. Shryock, Everson, Wash. App. filed Aug. 26, 1915. For continuing current after one series lamp has burnt out.

1,199,212. APPARATUS FOR DISTRIBUTING ELECTRIC CURRENT; F. M. Simpson, Montreal, Quebec, Can. App. filed Feb. 11, 1915. Supports wires on grooves so as to avoid poles in streets.

1,199,213. TRANSMITTING APPARATUS FOR WIRELESS TELEGRAPH STATIONS; F. G. Simpson, Seattle, Wash. App. filed Nov. 29, 1915. No resultant oscillations when condenser discharges through spark gap.

1,199,220. METHOD FOR PRODUCING PURE RETORT CARBON; E. Szarvasy, Budapest, Austria-Hungary. App. filed Feb. 12, 1915. Passes methane over flowing carbon fragments.

1,199,226. AUTOMOBILE THEFT ALARM; H. B. Alexander, St. Louis, Mo. App. filed Sept. 11, 1914. Alarm sounded as soon as vehicle commences to move.

1,199,239. INTERNAL COMBUSTION ENGINE; C. M. Buck, San Leandro, Cal. App. filed Sept. 23, 1912. Throws distributor out of engagement with the engine when not in use.

1,199,253. AUTOMATIC ELECTRIC WATER PURIFIER; G. E. Erickson, New York, N. Y. App. filed Dec. 28, 1915. Sterilizer and filter.

1,199,262. TELEGRAPHIC TRANSMISSION; J. Gell, London, England. App. filed March 8, 1911. Continuance for each receiving instrument.

1,199,276. FLASH LIGHT; M. L. Kaplan, Brooklyn, N. Y. App. filed Nov. 24, 1914. Improved thumb-operated switch.

1,199,282. TROLLEY MECHANISM; N. D. Levin, Columbus, Ohio. App. filed March 5, 1909. Specially for mine locomotives.

1,199,283. TROLLEY MECHANISM; N. D. Levin, Columbus, Ohio. App. filed March 5, 1909. Short-length trolley pole with few simple parts.

Record of Electrical Patents

Notes on United States Patents issued Sept. 26, 1916, prepared by Mitchell & Allyn, 41 Park Row, New York.

1,199,292. LOCKING SYSTEM FOR AUTOMOBILES; J. E. Minor & C. M. Page, Kansas City, Mo. App. filed Dec. 17, 1913. Combination lock for ignition switch.

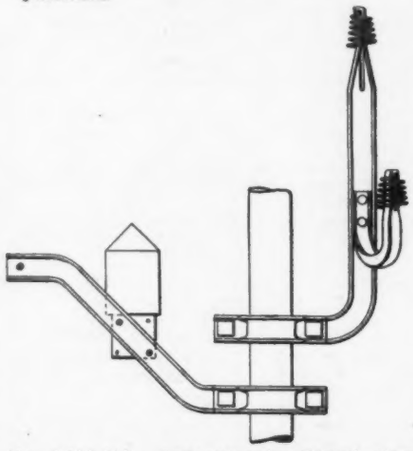
1,199,317. SEMI-AUTOMATIC TRUNKING SYSTEM; J. A. Taggart, Rochester, N. Y. App. filed Dec. 29, 1913. Automatic switching mechanism for establishing free connections from one subscriber to another.

1,199,326. ATTACHABLE SUPPORT FOR ELECTRIC LAMPS; L. Weil, Cleveland, Ohio. App. filed Sept. 30, 1915. Clamp construction for attaching lamps to shelves, beds, bookcases, etc.

1,199,338. TELEGRAPH SYSTEM; J. H. Bell, East Orange, N. J. App. filed Nov. 24, 1915. Repeater system.

1,199,339. TELEGRAPH SYSTEM; J. H. Bell, East Orange, N. J. App. filed Nov. 24, 1915. Double-current type.

1,199,340. COMPARTMENT OR BULKHEAD LEAKAGE INDICATOR FOR SHIPS AND THE LIKE; G. Block, Milwaukee, Wis. App. filed Dec. 30, 1912. For indicating height and rate of incoming flow in compartment.



No. 1,199,212. Apparatus for Distributing Electric Service

1,199,341. METHOD OF AND MEANS FOR ENERGIZING ELECTRIC GENERATORS; G. Bluemel, Chicago, Ill. App. filed May 21, 1914. Variable speed transmission between exciting generator and shaft of main generator.

1,199,348. CUT-OUT BLOCK; R. C. Cole, Hartford, Conn. App. filed Nov. 26, 1915. Fuse clips are held in pockets on insulating base.

1,199,349. HIGH TENSION TELEGRAPH CIRCUIT PROTECTOR; R. C. Cole, Hartford, Conn. App. filed Nov. 29, 1915 High tension insulating block at one end of fuse base and low tension insulating block at opposite end of base.

1,199,388. ELECTRIC SPEED SIGNAL; J. B. Kimpflin, Akron, Ohio. App. filed Oct. 17, 1914. Speed governed device switches different colored lights in circuit.

1,199,390. DRY BATTERY; A. Landau, Toronto, Ontario, Canada. App. filed Aug. 28, 1915. Insulated against the effect of changes in atmospheric conditions.

1,199,392. PEN FLASH LIGHT; W. Lenzikow & D. Buhler, New York. N. Y. App. filed Dec. 6, 1915. Mounted in cap and lies close to clip of fountain pen.

1,199,408. CHUCKING DEVICE; F. Muller, Hartford, Conn. App. filed Aug. 28, 1915. Open at one side to permit lateral removal of work piece.

1,199,428. ELECTRICALLY HEATED MOLD; J. M. Roth, Pittsburgh, Pa. App. filed Nov. 24, 1915. Core heated by heat radiated from the mold and not by electrically heating the core.

1,199,437. ELECTRICALLY PROTECTIVE DEVICE; B. H. Smith, & P. MacGahan, Turtle Creek, and Pittsburgh, Pa. App. filed Nov. 5, 1913. High tension relay with contacts an appreciable distance from the operating electric magnet.

1,199,444. ELECTRICAL MEASURING INSTRUMENT; T. W. Varley, New York, N. Y. App. filed March 3, 1911. Electro-motive force generated by a plurality of thermo-electric couples.

1,199,447. ELECTROMAGNET; R. Wikander, Pittsburgh, Pa. App. filed March 23, 1911. For unit switch control systems.

1,199,451. LATCHING DEVICE FOR KNIFE SWITCHES; G. L. Christman, & H. Baxter, Swissvale and Wilkinsburg, Pa. App. filed Feb. 5, 1914. For detachably securing the knife and can be applied to existing switches.

1,199,453. SYSTEM AND METHOD OF CONTROLLING ELECTRIC MOTORS; J. LeC. Davis, Pittsburgh, Pa. App. filed Nov. 11, 1911. Particularly for automobile electric motors.

1,199,459. DIRT-COLLECTOR FOR RECTIFIERS; S. W. Farnsworth, Pittsburgh, Pa. App. filed Nov. 6, 1914. Frees liquid electrodes of foreign substances.

1,199,466. IRON-PORCELAIN INSULATING-SUPPORT; R. P. Jackson, Edgewood Park, Pa. App. filed Feb. 19, 1914. For high voltage and of reduced size and simplified construction.

1,199,467. IRON-PORCELAIN INSULATING-BUSHING; R. P. Jackson, Edgewood Park, Pa. App. filed June 9, 1914. Outlet for power stations, etc.

1,199,468. MECHANICAL RECTIFIER; R. P. Jackson, Edgewood Park, Pa. App. filed June 9, 1914. Low-resistance path for waves of one plurality and conductor for waves of other plurality of low resistance when cold and high resistance when hot.

1,199,469. MECHANICAL RECTIFIER; R. P. Jackson, Edgewood Park, Pa. App. filed June 9, 1914. Substantially free from sparking throughout wide variations of load frequency and wave form.

1,199,472. ELECTROLYTIC APPARATUS; I. H. Levin, Newark, N. J. App. filed June 3, 1916. Bi-polar electric type.

1,199,477. CIRCUIT-INTERRUPTER; J. N. Mahoney, Wilkinsburg, Pa. App. filed Feb. 1, 1913. Oil type for handling heavy currents at high voltage.

1,199,478. CONTACT MEMBER; J. N. Machoney, Wilkinsburg, Pa. App. filed Nov. 28, 1913. Circuit interrupter for high voltage contact portions compactly arranged; constructed to effect disengagement at speed higher than movable contact member.

1,199,487. SEAL; H. A. Newcomb, Wilkinsburg, Pa. App. filed Aug. 6, 1915. Structure for vapor electric apparatus.

1,199,490. LIGHTING FIXTURE; H. Northwood, Wheeling, W. Va. App. filed April 4, 1916. Combined socket cover and support for reflector and bowl.

1,199,494. ARRANGEMENT FOR PRODUCING SHORT UNIDIRECTED HIGH-TENSION CURRENT; A. Pfeiffer, Berlin, Germany. App. filed Sept. 30, 1915. Primary current with short steep waves transformed to high tension by specially designed machine.

1,199,511. IGNITION DYNAMO; H. R. Van Deventer, Sumter, S. C. App. filed Oct. 28, 1915. Movable igniter contacts are used in connection with an oscillating magneto.

1,199,537. ELECTRIC-WELDING TRANSFORMER; E. Fulda, New York, N. Y. App. filed July 15, 1913. Roller contact makes continuous electrically welded seam.

1,199,539. IGNITION TESTING APPARATUS; A. Fulton, Western Springs, Ill. App. filed Nov. 26, 1915. Instrument for testing gas engine ignition while in operation.

1,199,545. INDICATING SIGNAL FOR VEHICLES; W. P. Hammond, Passaic, N. J. App. filed Dec. 27, 1910. Indicates direction vehicle is to turn.

1,199,558. ZINC ELECTRODE FOR GRAVITY-BATTERIES; L. R. Jones, Camden, N. J. App. filed July 21, 1916. Permits zinc to be effectively utilized.

1,199,560. AUTOMOBILE SIGNAL; W. E. Jones, St. Louis, Mo. App. filed Jan. 23, 1914. Direction indicator controlled by movement of steering wheel.

1,199,571. ELECTRIC LOAD-DISTRIBUTER; J. E. King, Syracuse, N. Y. App. filed Feb. 24, 1913. As applied to separate sources of supply merging into common distribution system.

1,199,582. METAL BURNER AND WELDER; P. Lynch, Rock Island, Ill. App. filed March 10, 1916. Suitable for ready attachment to ordinary lamp socket for welding and fusing metals, filling blow holes, etc.